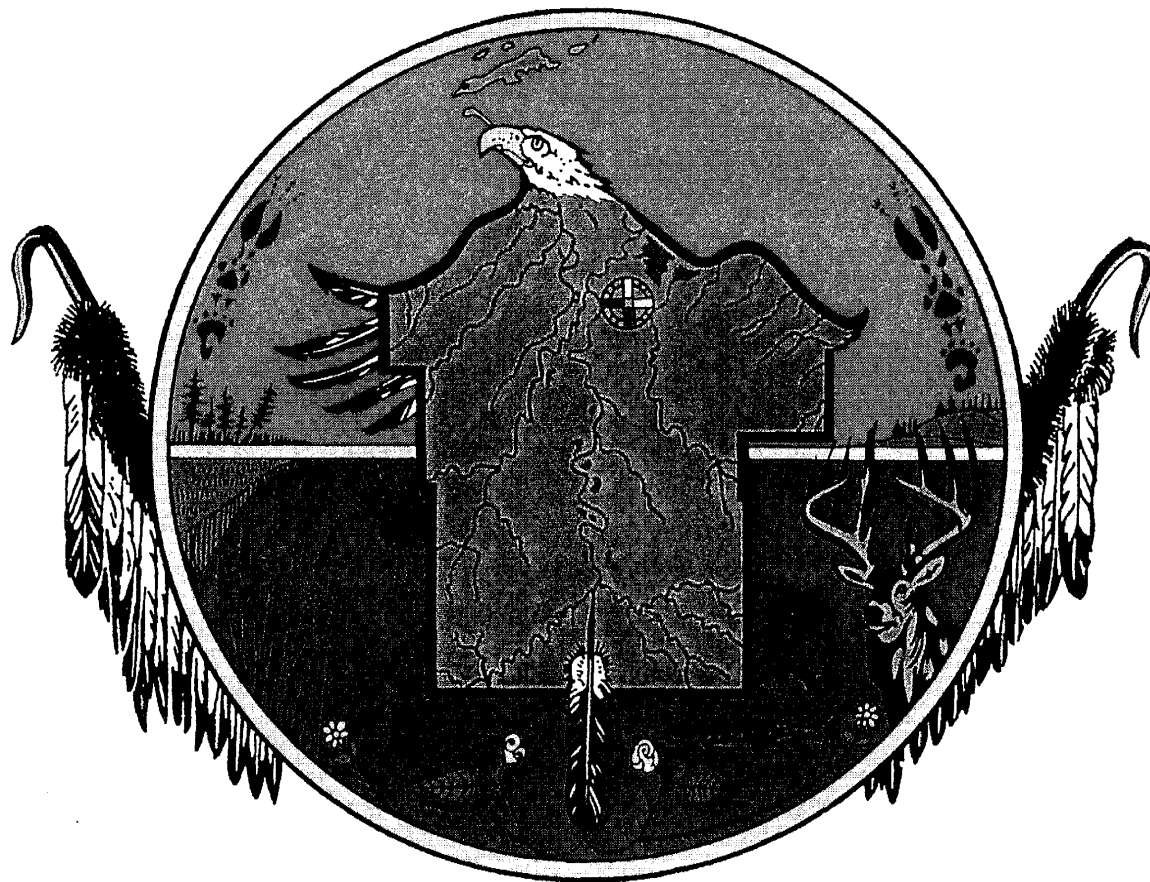


## **ATTACHMENT S**

### ***Bad River Tribal Integrated Resources Management Plan***

# **Bad River Band of Lake Superior Tribe of Chippewa Indians**



## **Integrated Resources Management Plan**

**2001**



**BAD RIVER RESERVATION**  
**Integrated Resources Management Plan**

2001  
for Seven Generations

Compiled by  
Joan Elias, Ecological Consultant

Concur: \_\_\_\_\_



\_\_\_\_\_  
Superintendent, Great Lakes Agency

Approved: \_\_\_\_\_



Approved: \_\_\_\_\_

7-2-01

\_\_\_\_\_  
Chairman,  
Bad River Band of Lake Superior  
Chippewa Indians  
by Tribal Resolution No. \_\_\_\_\_

\_\_\_\_\_  
Area Director,  
Minneapolis Area Office



**BAD RIVER BAND  
OF LAKE SUPERIOR CHIPPEWA  
INDIANS**

**Integrated Resources Management Plan**

**2001  
for the Seventh Generation**



# BAD RIVER BAND OF LAKE SUPERIOR TRIBE OF CHIPPEWA INDIANS

CHIEF BLACKBIRD CENTER

P.O. BOX 39 Odanah, Wisconsin 54861

RESOLUTION

4-4-01-77

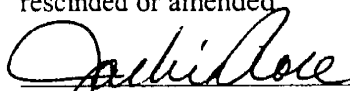
## Adopting the Bad River Integrated Resource Management Plan (IRMP)

- WHEREAS,** The Bad River Band of Lake Superior Tribe of Chippewa Indians ("Band") is organized under Section 16 of the Indian Reorganization Act of 1934, 25 U.S.C. Subsection 476, and the Bad River Tribal Council is the governing body of the Band pursuant to the Tribal Constitution; and
- WHEREAS,** Article VI Section (n) of the Bad River Constitution authorizes the Tribal Council to encourage and foster the culture, wildlife and natural resources of the Bad River Band; and
- WHEREAS,** The management of natural resources is important to assuring that natural resource goals and objectives of the Band are met; and
- WHEREAS,** The Integrated Resource Management Plan (IRMP), as developed pursuant to Resolution No. 12-5-90-155, attached, creates a long term comprehensive plan for the conservation, preservation, and sustainable use of all the natural resources of the Bad River Reservation; and
- WHEREAS,** The goal of this IRMP is to maintain and improve the health of ecosystems within the Bad River Reservation for at least the next seven generations, while providing resources at a sustainable level of harvest.

**NOW THEREFORE BE IT RESOLVED,** that the Bad River Tribal Council adopts the Attached Integrated Resource Management Plan and directs that it be implemented as the guiding document for the conservation, preservation, and sustainable use of the natural resources of the Bad River Reservation.

## CERTIFICATION

I, the undersigned as Secretary of the Bad River Band of the Lake Superior Tribe of Chippewa Indians, an Indian Tribe organized under Section 16 of the Indian Reorganization Act, hereby certify that the Tribal Council is composed of seven members, of whom 7 members, constituting a quorum, were present at a meeting hereof duly called, noticed, convened, and held on the 4 day of April, 2001 that the foregoing resolution was duly adopted at said meeting by an affirmative vote of 6 members; 0 against; and 0 abstaining, and that the said resolution has not been rescinded or amended.



Jackie Rose, Secretary  
Bad River Tribal Council



## **EXECUTIVE SUMMARY**

The federal government requires tribes with forested reservation land to develop a Forest Management Plan or a more extensive Integrated Resources Management Plan (IRMP). The Bad River Band of Lake Superior Chippewa Indians adopted a tribal resolution to develop an IRMP in 1990. An IRMP is a comprehensive, long-term plan that provides for the conservation, preservation, and sustainable use of all the natural resources of the Bad River Reservation. The goal of Bad River's IRMP is to maintain and improve the health of ecosystems within the Bad River Reservation for at least the next seven generations, while providing resources at a sustainable level of harvest.

To determine how Bad River members would like to see their resources managed the Bad River Natural Resources Department asked members to fill out a questionnaire in 1994. Bad River members indicated that their greatest concerns centered on protection of the environment, especially water quality. The interdisciplinary team that developed this IRMP addressed and incorporated the comments and concerns raised by tribal members throughout the development of the plan.

Three principles guided the development of this IRMP: 1) protection of the environment and natural resources; 2) respect for the earth and all living things; and 3) the belief that we have a moral responsibility to the Seventh Generation. We must manage our natural resources in an intelligent manner so the Seventh Generation can enjoy the same environmental quality that we enjoy today. Intelligent management of natural resources means emphasizing the protection of resources and biodiversity over maximizing short-term economic gain.

The Bad River IRMP is focused on the following resources: soils, minerals, water, air, transportation, recreation, cultural, vegetation, wetlands, timber, fish, wildlife, and threatened and endangered species. This document describes the current condition of each of these resources, lists a set of known issues or problems relating to each resource, and outlines a series of goals and objectives designed to begin addressing these issues. By examining resource use in an integrated manner, the Band has

attempted to ensure that the sustainable use of any one resource does not negatively affect any other resource.

A fundamental management concept proposed in this IRMP is to manage reservation lands according to specific Resource Management Areas. These areas are naturally-formed regions based on vegetation and terrain, and include additional buffer areas which help to protect vital resources, such as water quality. The Resource Management Areas guide the type of resource use that should occur in various areas so that the long-term sustainability of the Reservation's resources can be protected. It is only through careful long term planning, such as this IRMP, that the Bad River Band can protect all resources for the benefit of tribal members today and future generations.

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## **INTRODUCTION**

The purpose of this document is to provide a comprehensive, long term plan for the conservation and sustainable use of the natural resources of the Bad River Reservation, located in northern Wisconsin (Figure 1). Management of natural resources on the Bad River Reservation occurs within the context of watersheds that are larger than the Reservation. The watersheds of the Bad River, Kakagon River, and on a larger scale, Lake Superior are affected by management activities on both sides of the Reservation boundaries. It is the goal of this management plan to maintain and improve the health and integrity of ecosystems within the Bad River Reservation, and within the larger watersheds of which the Reservation is a part, for at least the next seven generations, while providing resources at a sustainable level of harvest.

The contributors of this Integrated Resource Management Plan (IRMP) understand that a document such as this is never complete. While this IRMP will be revised approximately every 10 years, the underlying beliefs and principles that guided its development are expected to continue guiding management decisions in the future.

### **DEVELOPMENT OF AN INTEGRATED RESOURCE MANAGEMENT PLAN**

The development of a Forest Management Plan (FMP) is required for all Indian Forest Lands by the Code of Federal Regulations (CFR, Title 25, Indians, Part 163.11). The Bad River Band chose to pursue an IRMP in lieu of a FMP to ensure all the Reservation's resources were fully addressed (Tribal Resolution 12-5-90-155 and IRMP MOU approved 10/91). 30 BIAM Supplement 10 authorizes and encourages the development of IRMPs, and it requires the IRMP be approved by both the Tribal Council and the Bureau of Indian Affairs (BIA) Area Director.

On March 6, 1992, the Bad River Band (hereafter referred to as the Band) entered into a self-determination contract with the BIA to undertake the responsibility of coordinating and completing the IRMP. An interdisciplinary team (ID team), comprised of Bad River community members, resources managers from within the Bad River Natural Resources Department, and conservation specialists from various agencies in the region, collaborated in the preparation of this document.

To determine how tribal members would like to see their resources managed, the Bad River Natural Resources Department (BRNRD) mailed a questionnaire to Bad River

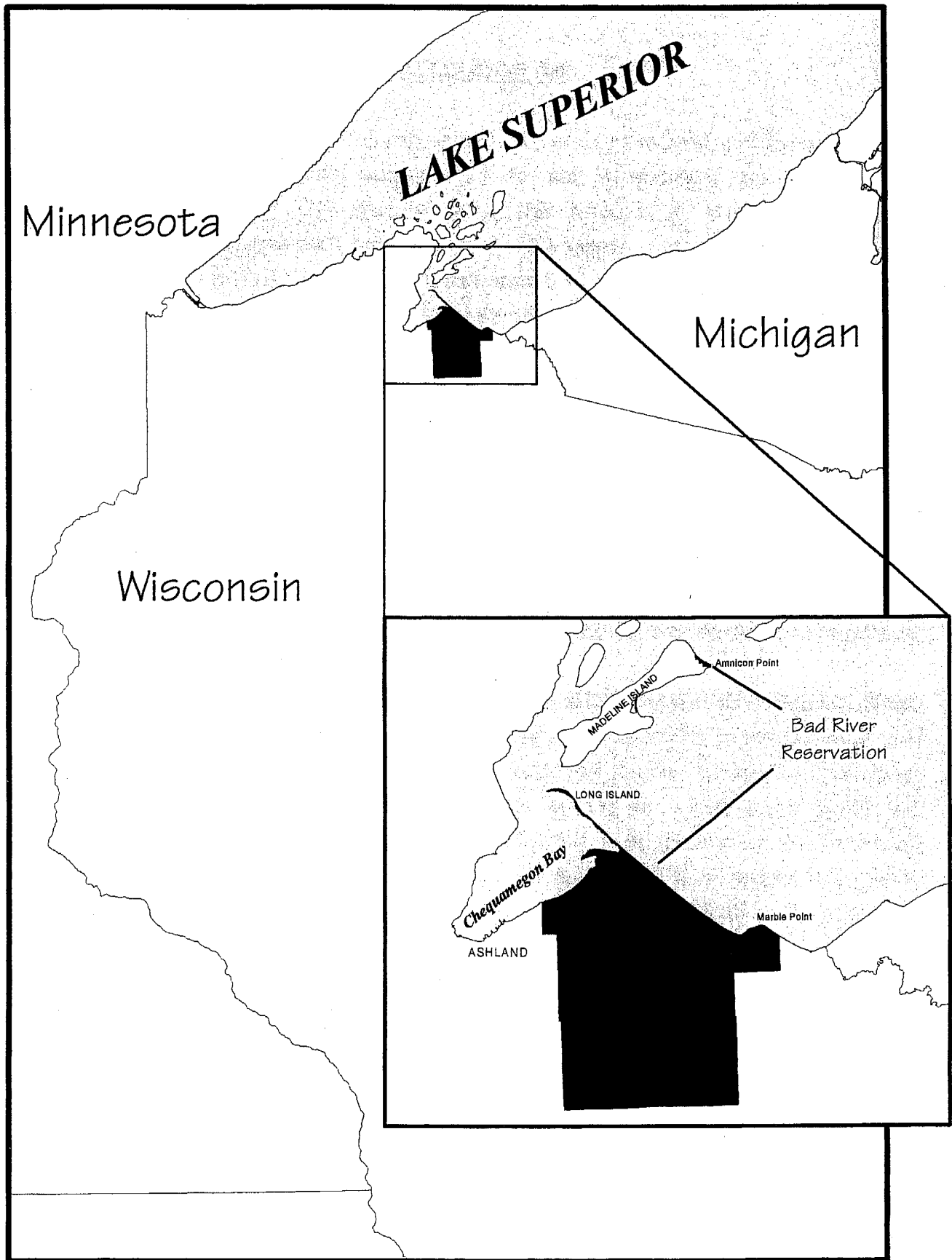


Figure 1. Location of Bad River Reservation

tribal members in April of 1994. The questionnaire was the first formal attempt to solicit input from tribal members on the management of natural resources on the Bad River Reservation. Responses to the questionnaire (summarized in Appendix A) indicated that tribal members have a great concern for the protection of their environment. Throughout the development of this IRMP the ID team has attempted to address and incorporate the comments and concerns raised by tribal members in the questionnaire.

According to responses to the Bad River IRMP questionnaire, the greatest area of concern among tribal members is the protection of the natural environment, especially water quality. In addition to maintaining the quality of both surface water and groundwater, important conservation issues within the Bad River Reservation, as determined by the IRMP ID team and responses to the questionnaire, include preserving, enhancing, and restoring native biodiversity, and protecting natural processes (e.g., nutrient cycling, soil formation, and natural water level fluctuations) important to the proper functioning of ecosystems.

Responses to the questionnaire also indicated that a great proportion of tribal members feel that the Band should be the primary authority for environmental protection on the Reservation. There is also very strong support (about 80% of responses) for designating specific areas of the Reservation for specific uses, such as residential, business, industrial, recreation, and conservation. During the IRMP planning process, data on natural resources (e.g., water quality data, wildlife surveys, threatened and endangered species locations, surveys for natural conifer regeneration), as well as traditional, ceremonial, cultural, religious, and spiritual considerations, had a great impact on the uses designated for all areas on the Reservation.

Land ownership on the Bad River Reservation is divided among tribal trust, tribal fee, allotted, and alienated lands (Figure 2). Trust land is Reservation land owned by the U.S. government in trust for an Indian Tribe or an individual Indian. Fee land is land that is acquired by a Tribe on or off Reservation, not in trust, with an ordinary title. Allotted land is either Reservation land owned by the U.S. government in trust for individual Indians (trust allotment), or owned by an individual Indian subject to a restriction imposed by the U.S. government against alienation (restricted fee allotment). Alienated land is Reservation land that is no longer owned in trust by the U.S. government for a Tribe or a tribal member, and is owned by a private party.

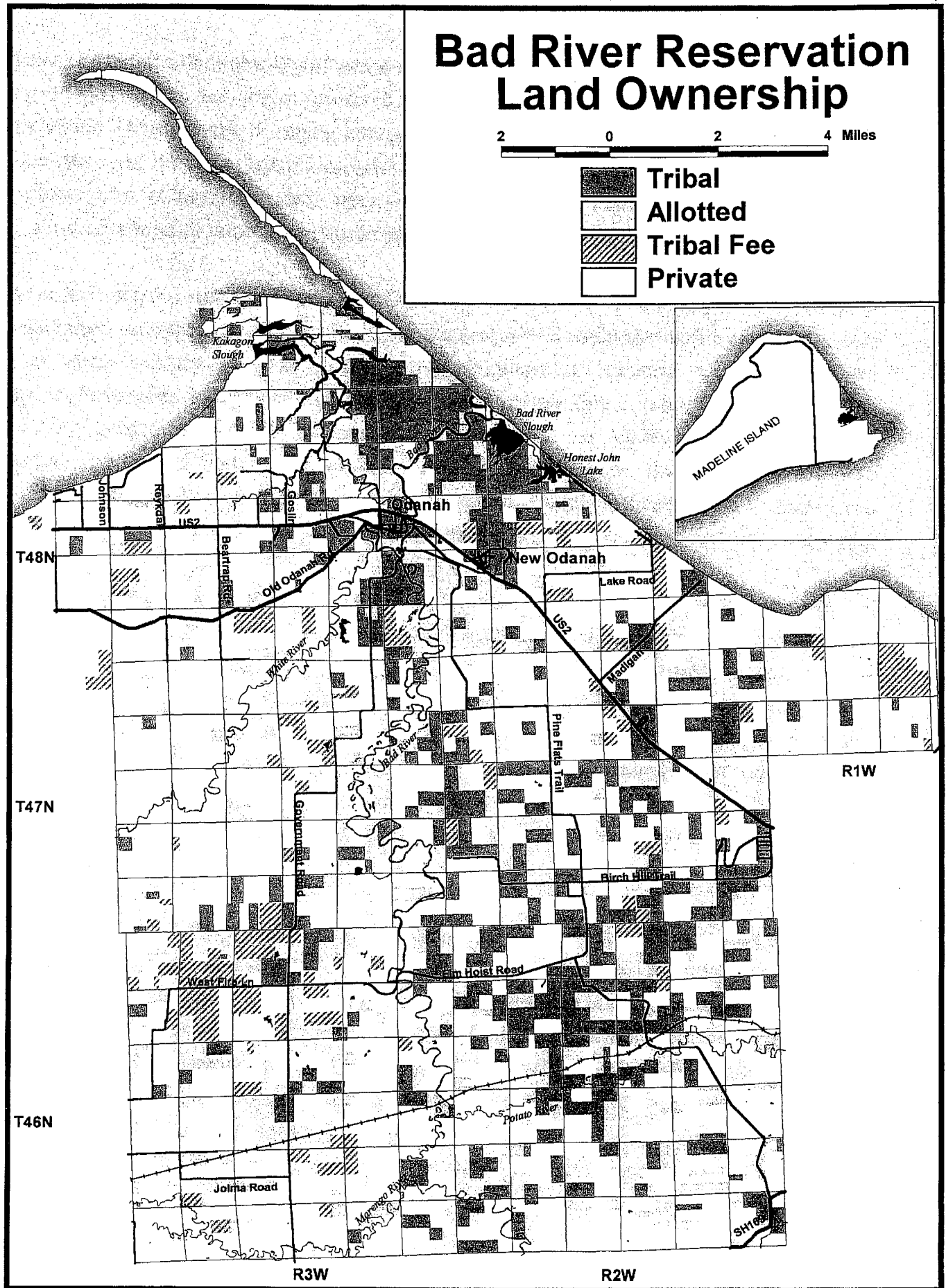


Figure 2. Land Ownership on the Bad River Reservation

The scattered distribution and unresolved jurisdictional nature of alienated lands on the Bad River Reservation have frequently diminished the effectiveness of resource management activities undertaken by the Band on adjacent trust lands. In addition, this fragmentation of land ownership has resulted in resource use on the Reservation that is not always condoned by the Band. Privatization of the land base has reduced the options available for the management of natural resources throughout all lands on the Reservation. For example, most of the private lands are owned by industrial timber companies, whose primary concern is pulp production and extraction. The production and extraction of pulpwood is accomplished on the Reservation primarily by clearcutting aspen, the practice of which is often not compatible with long-term management goals of the Band. In instituting this resource management plan, the Band expects to overcome many of these difficulties through voluntary compliance by private landowners.

It is important that the Band initiate a resource management plan that considers the fragmented nature of land ownership within Reservation boundaries. Since the health of one resource often depends on the proper management of other resources, the Band's management plan must consider the integrated nature of these resources. It is with these ideas in mind that the Bad River Band chose to manage the natural resources on the Reservation using an ecosystem approach.

### **IRMP GOALS**

The following goals of this IRMP are based on the vision and beliefs of the Bad River Band, the concepts of sustainability, and the principles of ecosystem management: protection and improvement of water quality, protection and enhancement of native biodiversity, protection of ecosystem integrity, and protection and improvement of the quality of resources for the Seventh Generation.

### **VISION STATEMENT**

Looking forward to the Seventh Generation, the Bad River Band of Lake Superior Chippewa Indians hopes to achieve the following vision of the Bad River Indian Reservation:

Our vision is of a Reservation where all living things are in natural balance and are no longer threatened with negative anthropogenic (human-made) impacts; where all individuals and institutions value the gifts of Mother Earth and willingly choose to act in a manner which ensures achievement of sustainable

environmental and economic goals; where every Bad River member, young and old, shares in the benefits of a healthy environment; where each Bad River member maintains the traditional cultural values necessary to live harmoniously with the natural world; where every Bad River member accepts the personal responsibility and challenge of pollution prevention in his or her daily life, and is committed to moving from a consumer-oriented society to a conservation-minded society; where the Bad River Band gives high priority to the protection of its environment, its natural resource base, and the functions of the natural systems on which all life depends; where the majority of the Bad River Band's subsistence needs are provided for by the local community.

## **BELIEFS**

We believe the earth is a living entity and deserves the respect and honor that every living thing is entitled to receive.

We believe that the Bad River Indian Reservation and the Bad River Band have been so historically joined that, as a People, no other place can be called home.

We believe water is the life blood of the environment and the quality of the water determines the quality of life.

We believe we have a moral responsibility to the Seventh Generation.

We believe the Seventh Generation is entitled to at least the same environmental quality that we presently enjoy.

We believe that in order to ensure the Seventh Generation shares in a high quality of Reservation resources, all human development activities must proceed in the most conservative manner possible.

We believe that the reduction of over-consumption and waste will reduce the burden on the environment and will contribute to a higher quality of life for all tribal members.

We believe that healthy ecosystems will be maintained by understanding, respecting, rehabilitating, and protecting natural resources and ecological processes.

We believe that maintaining and promoting biological, social, and cultural diversity is essential for a long-term sustainable environment, and that such diversity creates a resilient base for the ecosystem.

We believe there is a limit to the amount of resources that can be safely removed from a healthy ecosystem.

We believe that environmental protection and enhancement strategies must be improved in order to meet the environmental challenges of the future.

We believe the Bad River Band must take a leadership role in the development and implementation of sustainable development policies and standards of conduct.

We believe tribal members must return to their traditional roots for the spiritual foundation that is needed to suppress the urge to take more than they need.

## **CONCEPTS OF SUSTAINABILITY**

Sustainability of a resource or an ecosystem implies more than just the continued production of a harvestable product, such as timber. While it is important to ensure that resources are available for harvest seven generations from now, it is also crucial to maintain the health and integrity of the environment in which we, and all natural resources, live. Sustainability not only means the continued production of a resource, but also the maintenance of ecological processes and functions (e.g., nutrient cycling, hydrology, soil formation, and fire and flooding disturbances). A sustainable activity is one in which biodiversity is preserved; in other words, the diversity of life at the genetic, species, and community level is protected and the ecological processes that connect everything remain intact.

## **ECOSYSTEM MANAGEMENT**

An ecosystem is a community consisting of all the component organisms (plant, animal, fungi), the abiotic (non-living) environment, and processes (e.g., nutrient cycling, disturbance, and succession) which together form an interacting complex. Ecosystem management is a system or process designed to assess, protect, conserve, and restore

the composition, structure, and function of an ecosystem, and to maintain sustainability across a variety of spatial and temporal (time) scales for the continued ecological, economic, and social benefits of society. In other words, ecosystem management is a process designed to protect plants and animals and their environments, while allowing benefits to people. While typical management practices consider only a few pieces of the ecosystem, for example, commercial tree species or important game species, ecosystem management takes the whole ecological system into consideration. This integrated approach is appropriate because the condition of resources is inter-related, with the health of one resource often depending on the proper management of another resource. A consistent monitoring effort to evaluate the results of various management practices is crucial to ecosystem management. When monitoring shows an adverse effect of a certain management practice, managers must be flexible and consider halting or changing the practice inflicting damage. When the consequences of management are unknown, managers should err on the conservative side to maintain ecosystem integrity.

According to Christensen et al. (1996) ecosystem management must include the following components:

- 1) Long-term sustainability. Management should be conducted in a way that ensures the opportunities and resources that we enjoy today are available to future generations.
- 2) Clear, operational goals. Goals should not focus exclusively on products, such as board feet or numbers of furbearers, but should be described in terms of the desired future condition of the ecosystem and should be expressed in a way that facilitates monitoring.
- 3) Sound ecological models and understanding. Ecosystem management is based on ecological principles and depends on research conducted at all levels of organization, from the genetic level, through populations and communities, and includes natural processes at all levels.
- 4) Understanding complexity and interconnectedness. Biological diversity and structural complexity of ecosystems are critical to the maintenance of ecosystem processes, and as such may increase stability and sustainability of the ecosystem.

Ecosystem management recognizes that uncertainty is inherent in complexity, and that unlikely events will occur (e.g., blowdowns, droughts, floods, fires).

5) Recognition of the dynamic character of ecosystems. Attempts to maintain ecosystems in a particular state (such as perpetual aspen management on a given site) are futile. Sustainability does not mean the perpetual maintenance of the status quo. Individual resources must be managed within the context of all ecosystem components and processes.

6) Attention to context and scale. No single appropriate scale or time frame for management exists, as ecosystem processes operate over a wide range of scales, both temporal (in time) and spatial (in space). At any one location, these processes are affected by the condition of the systems and landscape surrounding them. Management must occur on a variety of scales, such as at the forest stand level as well as the watershed level.

7) Acknowledgment of humans as ecosystem components. The effects of humans on the landscape can be seen everywhere. Increasing population growth and the concurrent demand for natural resources requires more intensive and intelligent management, particularly if human needs are to be met in a sustainable manner. It is important to involve people in the management of ecosystems because they depend on natural resources for their survival, and the health of the ecosystem depends largely on people's actions.

8) Commitment to adaptability and accountability. Our current knowledge of ecosystems and their functions is incomplete. As research and monitoring efforts continue, managers must be adaptable, or flexible, in their management strategies, so that they may discontinue adverse management practices when such practices have been identified.

The goals fundamental to ecosystem management are: 1) to maintain viable populations of all native species, 2) to represent, within protected areas, all native ecosystem types across their natural range of variation, 3) to maintain evolutionary and ecological processes (e.g., disturbance regimes, hydrological processes, nutrient cycles), 4) to manage over long periods of time, so that the evolutionary potential of

species and ecosystems is maintained, and 5) to accommodate and balance human use and occupancy within these constraints (Grumbine 1994).

Based on these general concepts, ecosystem management goals specific to the Bad River Reservation include: 1) protect and improve ground and surface water quality, 2) preserve native biodiversity of plants and animals, 3) protect threatened and endangered species, 4) restore ecosystem components that have been reduced or eliminated since the time of European settlement (e.g., white pine, white cedar, moose, sturgeon), 5) protect remnant vegetation communities (i.e., those communities that were historically widespread but now are greatly diminished in size and relatively isolated from other areas of the same community type) , and 6) preserve and restore natural processes (e.g., nutrient cycling, water level fluctuations, decomposition) necessary to sustain the healthy functioning of the ecosystem.

While the Bad River Band may not have the ability --financial or otherwise-- to conduct extensive research on multiple scales, it can benefit from research conducted by others. The staff of the BRNRD remains informed of current natural resource management research and recommendations, and can contribute to amendments of this IRMP at appropriate intervals in order to implement strategies based on the latest research.

## **RESOURCE MANAGEMENT AREAS**

Patterns of land use and development have profound impacts on all aspects of the environment. The structure of our communities and outlying areas, the ways in which we construct infrastructure for transportation and water supply, the manner in which we harvest resources for wood products and fiber production, our use of the land as a source of raw materials, and our recreational activities all contribute to the nature and extent of our impact on environmental systems. Soil erosion, excessive flood damage, air and water pollution, species extinction, loss of genetic diversity, deforestation, water shortages, and global climate change are some of the adverse consequences that can result from poor land use decisions and lack of a long-term perspective. One way to prevent such environmental problems is to identify areas where negative impacts are occurring, or are likely to occur, and designate the types of land use such that fragile areas will be protected.

Consistent with the goals of this IRMP (page 6), the IRMP ID team identified specific areas of the Reservation relative to resource use and protection (Figure 3; enlargements of Figure 3 are presented in Appendix B). Conservation Areas are unique areas, and worthy of protection. Watershed Protection Areas are fragile areas, especially susceptible to soil erosion, and therefore also in need of protection. Limited timber harvest and forest restoration efforts are appropriate in Restoration Areas. Forest Management Areas are suitable for extractive purposes, primarily timber production.

Designation of Resource Management Areas is based on the principles of ecosystem management, the concepts of sustainability, and the beliefs of Bad River Band Members. Identifying areas to protect, areas where timber harvest will be limited, and areas for larger-scale timber production will protect water quality, enhance biodiversity, provide restoration opportunities, preserve natural processes crucial to proper ecosystem functioning, and promote sustainable use of resources.

The Resource Management Areas designated by this IRMP form a critical foundation for the development of a comprehensive land use plan which incorporates residential, commercial, and other areas. With this foundation, any future land use plan developed by the Band will be based upon the protection of natural resources.

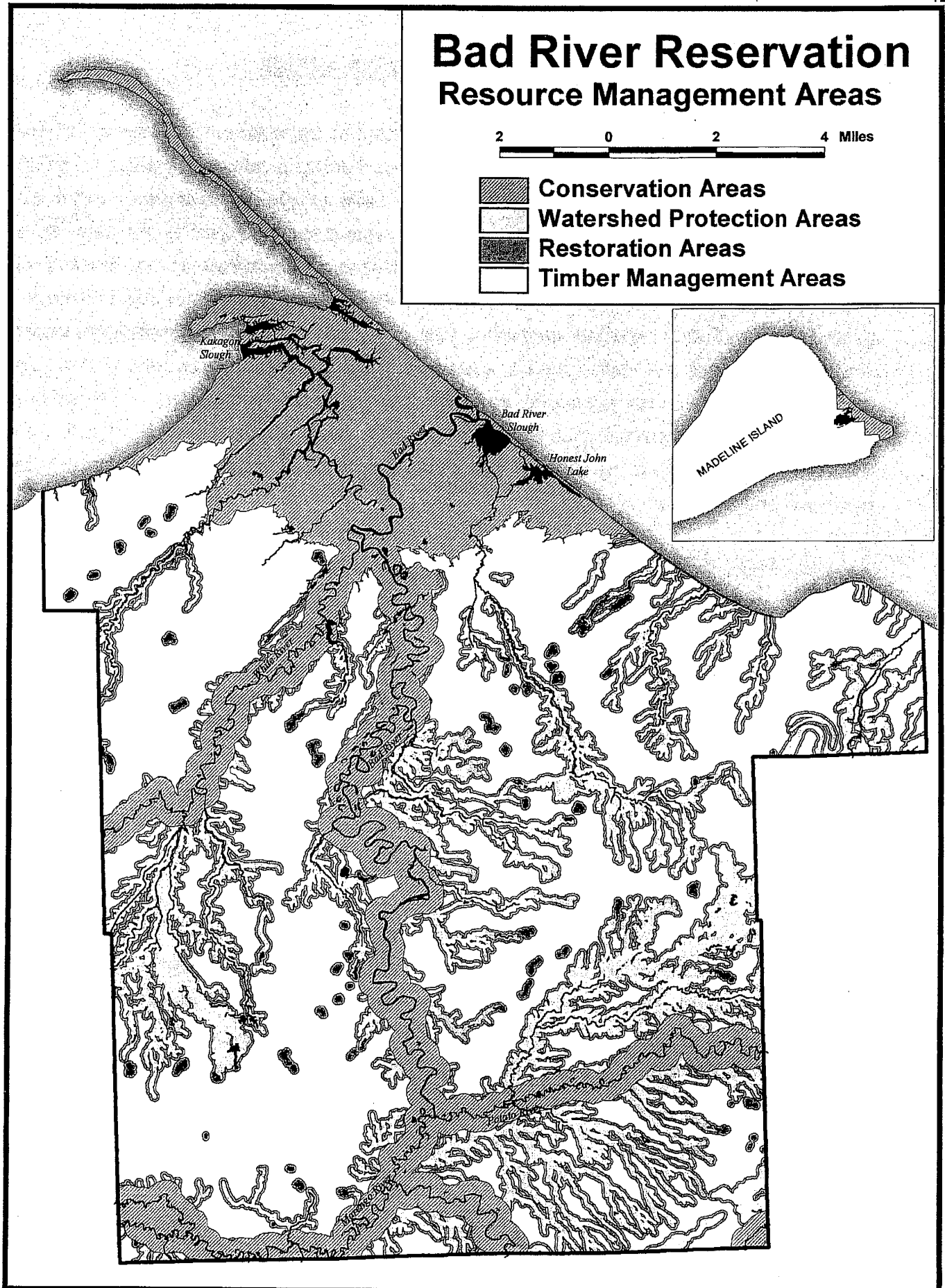


Figure 3. Resource Management Areas on the Bad River Reservation

The specific Resource Management Areas on the Reservation are described below. Because management of forest resources has the largest potential impact on other resources on the Reservation, the discussion of management in the various areas is dominated by timber issues and management practices.

### **Conservation Areas**

The Kakagon and Bad River Sloughs wetland complex, lands on Madeline Island, and major floodplains (approximated by an area 1/4 mile wide on both sides of the Bad, White, Marengo, and Potato Rivers) are designated as Conservation Areas (Figure 3). Conservation Areas will be managed primarily for their natural ecological and cultural values and will be protected from timber harvest activities as well as future residential, industrial, and recreational development.

For generations, the Kakagon and Bad River Sloughs have provided the Bad River community with their subsistence needs. In addition, the cultural and spiritual values the Sloughs provide to the Band are innumerable. Scientific research has identified the Kakagon and Bad River Sloughs as the most pristine wetland complex on the Great Lakes. The U.S. Department of Interior recognized this fact, and in 1983 designated the Kakagon Slough as a National Natural Landmark, describing it as "an excellent representative of a true freshwater delta by virtue of its large size, complex mixture of marsh, bog, and dune vegetation types and undisturbed conditions." Because of their great importance, the Slough areas are part of the IRMP Conservation Area designation - giving them the highest degree of protection from adverse management actions.

The floodplains along the major rivers on the Reservation, generally located below steep slopes leading up to the flat clay plain, are another important Conservation Area. Annual spring floods scour the river banks on outside bends of the rivers and deposit rich alluvial soils on the inside bends. These alluvial soils support an amazing diversity of plant life, including a rich spring ephemeral community and floodplain forests with an old growth component.

The tribal land on Madeline Island, also designated as a Conservation Area, is of great spiritual significance to tribal members. A forested area and a large coastal wetland cover the tribally-owned portion of the island. Parts of the forested upland were cut in

the 1960s. The coastal wetland, which formed behind a sand spit, is known for its cranberry bogs.

The lands designated as Conservation Areas are unique within the Reservation and are significant on a regional scale as well. The protection of these areas from development and timber harvest demonstrates the Band's commitment to maintaining the health of unusual and valuable communities.

### **Watershed Protection Areas**

Timber harvest in areas adjacent to open water and slopes contributes to the potential loss of biodiversity and degradation of water quality on the Reservation. Many wildlife species depend upon water and the surrounding habitat during some part of their life cycle (e.g., waterfowl, frogs, toads, mink, otter). The loss of forested areas adjacent to open water bodies reduces critical nesting, feeding, resting, and thermal cover (shelter from cold and heat) habitat for many wildlife species. The presence of trees on a landscape slows the rate at which rain reaches the ground, giving the water a chance to soak into the ground (infiltrate), instead of quickly running off. Logging decreases the interception and infiltration of precipitation leading to increased runoff and stream flow. As surface runoff accelerates, streams experience greater sediment loads (the amount of soil particles carried by a stream; streams that look muddy have high sediment loads), contributing to the degradation of water quality. Activities associated with logging, such as road building and log skidding, can exacerbate runoff sedimentation (the accumulation of soil on the stream bottom) and lead to streambank erosion and flash flooding.

Clearcutting of upland hardwood and conifer forests can increase local streamflow due to runoff by as much as 80% and double peak flows, with effects persisting up to 15 years after the cut (Verry 1986). The largest determinant of increased streamflow is the amount of area cut as a percent of the total watershed area. Particular tree species may, however, play an important role in reducing spring flooding. Conifer canopies shade the ground in winter, slowing the melting of the snowpack, thereby reducing the intensity of spring runoff and lessening sedimentation problems. Ravine areas can be protected from erosion and slumping by prohibiting timber extraction on slopes or managing for long rotation of conifer tree species.

Forest management practices can also affect the biological properties of stream water. Nutrients such as phosphorus which are released after a clearcut can lead to increased algae production. Increased sedimentation as a result of streambank slumping and other erosion can decrease biotic productivity in aquatic systems. (For example, the accumulation of sediment can bury fish eggs and bottom-dwelling organisms. Heavy sediment loads within the water can prevent plants from photosynthesizing.) Since living tree roots provide support for streambanks, slumping may be exacerbated by harvesting in close proximity to streams. Even clearcutting on uplands can contribute to sedimentation as increased infiltration and groundwater pressure may weaken streambanks and promote slumping and surface runoff (Cooper, personal communication).

Forest management practices currently should follow BRNRD Best Management Practices (BMPs) on tribal trust and fee lands, and Wisconsin Department of Natural Resources BMPs (WDNR 1995) on alienated lands. Conformance to these guidelines on the Reservation has not been monitored. The ID team and the BRNRD feel that the current BMPs (both tribal and WDNR) do not provide adequate protection to the streams and stream banks. Slumping of the river banks occurs along the White and Bad Rivers. Conifers, which contribute to greater soil stability than deciduous trees on slope areas, are not regenerating well in most places. The Resource Management Areas described in this IRMP, will protect areas not protected adequately under tribal and WDNR BMPs.

The purpose of the Watershed Protection Area is to protect water quality of streams, rivers, lakes, and wetlands. To accomplish this goal, timber harvest will be prohibited on slopes greater than 15%, and in a buffer area of 100 feet (30.5 meters) surrounding open water areas and along the top of 15% slopes (Figure 3). Conifer tree species will be encouraged in order to help ensure soil stability and enhance biodiversity in these buffer areas. Single trees may be cut, but not removed, only for the purpose of releasing conifers in the 100 foot buffer area.

A buffer such as that described above can be viewed as an ecosystem in and of itself, with ecological significance on the landscape. Often these areas are transitions between aquatic and terrestrial ecosystems, and have extremely high biodiversity. Protection of these transition areas has relevance to the larger watershed and biodiversity goals.

The benefits of this buffer zone are numerous. Water quality will be protected through decreased nutrient loading, soil erosion, and soil compaction. This buffer will provide crucial habitat for wildlife, especially thermal cover which is required by many species. A buffer zone extending 100 feet away from ravine edges will help ensure slope stability and allow for regeneration of conifers, which often occur on slopes in the Reservation. Buffers can also slow the spread of weedy species from adjacent logged or disturbed areas.

### **Restoration Areas**

While a 100 foot buffer surrounding open water and slopes may be adequate for water protection, a larger buffer surrounding these features is necessary in order to promote regeneration of some tree species and provide travel and dispersal corridors for many wildlife species.

The areas from 100 - 330 feet (30.5 - 100 meters) of slopes and open water have been designated as Restoration Areas (Figure 3). Goals for this extended buffer area include increasing biodiversity by providing habitat generally absent from active timber production areas, promoting a forest that is older than that currently found on the Reservation, and restoring forest components that have been diminished since pre-European settlement times. Forest characteristics that will be enhanced within the Restoration Areas include a complex forest structure, large amounts of woody debris, large dead and down trees, large trees with cavities, and a high proportion of conifers.

To accomplish the goals of the Restoration Areas, approved timber harvest activities will be targeted toward restoring and enhancing mixed species, multi-aged forest communities using low-intensity management techniques. These techniques may include selective harvesting where appropriate, reforestation, and other non-commercial management. A portion of the profits from timber sales will be used to plant conifers in these areas in such a way that the planting does not resemble a plantation (i.e., no straight rows, a mix of species if possible).

The first official restoration effort began in 1996, when white pine seedlings were planted under existing aspen-red maple forests by the BRNRD. Additional planting of white and red pines and other conifers, such as white cedar and hemlock, is appropriate in Restoration Areas.

### **Forest Management Areas**

Land not designated as Conservation Areas, Watershed Protection Areas, or Restoration Areas are the commercial forest areas of the Reservation (Figure 3). These remaining areas will be managed based on sustainable forestry concepts. Management will focus on the goal of a healthy, productive forest with an increased conifer component and a reduced aspen component. As comprehensive land use planning proceeds on the Reservation, some of these areas (particularly near U.S. Highway 2) will be reassigned to other uses, such as residential, recreation, and commercial.

Current forest management practices need to be re-examined. Forest management on the clay soils of the Reservation presents challenges relative to maintaining certain tree species, as well as avoiding soil damage.

Approximately 50% of the Reservation is currently dominated by aspen forests. In many cases conifers are not present in the understory and seed sources may be absent or so distant that natural re-seeding of these areas will require many years. The length of time needed for trees to reach seed-production maturity on various soil types and the effective distance of seed dispersal directly impacts the rate of spreading for a particular tree species. Methods to improve soil conditions for conifer seedling establishment should be investigated.

Evapotranspiration (water lost from the land through evaporation plus that given off by plants through transpiration) by trees influences soil moisture. Clearcutting of aspen on level clay soils causes the area to become wetter for a number of years. The site will remain in this saturated condition until a sufficient leaf canopy area has developed to reinstate the evapotranspiration drying process. Manual interplanting of conifers such as white cedar, tamarack, and white pine into these areas is a potential option for increasing evapotranspiration after a clearcut.

Clay plain and wet soils areas in particular, are susceptible to windthrow problems (where trees blow down due to strong winds). To prevent windthrow as a result of timber harvesting, it is important to pay attention to clearcut size and configuration. Isolated seed trees surrounded by large clearcuts may require an uncut buffer area around them in order to minimize windthrow damage.

Further discussion of forest management can be found in the Timber section of this document (beginning on page 65). A compilation of statistics derived by Geographic Information System (GIS) analysis of land ownership, vegetation cover, landtypes, and Resource Management Areas are presented in Appendix C.

## **ALTERNATIVE PLANS**

### **Resource Management Area Alternative (Recommended)**

The above description of Resource Management Areas is the alternative management plan recommended by the ID team, as it represents an acceptable compromise between the two other alternatives described below (Forest Preservation Alternative and Timber Production Alternative). The specified Resource Management Areas will protect water quality, enhance native biodiversity, protect ecosystem integrity, and protect and improve the quality of resources for the Seventh Generation, while still allowing the Band and allottees to receive profits from the sustainable harvest of resources on some areas of the Reservation.

Under this alternative, some trust and allotted land lies within areas where timber harvest is prohibited (Conservation Areas and Watershed Protection Areas) or where timber harvest is restricted to select cut (Restoration Areas). While the Band and individual allottees may not be able to maximize their short-term economic gain on these lands, the value of conserving biodiversity cannot be overemphasized.

Biological resources, such as timber, wildlife, water, wetlands, and medicinal plants, have many values to humans. They provide food, shelter, fuel, medicine, recreational opportunities, and cultural values. Biological resources also provide environmental services such as watershed protection, cleansing of water, prevention of soil erosion, production of oxygen, absorption of carbon dioxide, and even regulation of the climate.

Biodiversity, which is more than biological resources alone, encompasses genetic diversity, species diversity, and ecosystem diversity. Biodiversity can be defined as the differences among biological life forms and the habitats in which they reside, rather than the different life forms, or resources, themselves (Wood 1997). The value of biodiversity to people is that it is the source of biological resources. In other words, biodiversity is required before long-term sustainable management of resources can occur. A cost-benefit analysis is not appropriate with regard to biodiversity because individual resources (e.g., timber, wildlife, water) cannot be substituted for biodiversity. In order to maintain biological resources for long-term sustainable use, biological diversity must be protected first.

A dollar amount can be assigned to individual biological resources and ecosystems, however. For example, an individual pine tree sold to a lumber mill, a stand of aspen sold to a pulp mill, an individual deer sold to a restaurant, and preservation of functional wetlands vs. construction of a storm water storage system are all values that can be calculated in dollars and cents. Such calculations have been attempted, resulting in surprisingly high figures. For example, Costanza et al. (1997) estimated the minimum value of the earth's ecosystem services to be \$33 trillion per year. To put this into perspective, the entire global gross national product (all the goods and services produced around the world each year) is approximately \$18 trillion per year.

While the high dollar value attributed to natural resources and ecosystems is astonishing, the long-term sustainable management of natural resources and the continued natural functioning of ecosystems is not possible without biodiversity. It is not feasible, nor is it proper, to assign a dollar value to biodiversity.

The conservation of biodiversity is not an economic issue: it is an ethical issue. Not only will people today benefit in the long-term by conserving biodiversity, but future generations will depend on the degree to which we, today, protect biodiversity. As Paul M. Wood says in his article entitled "Biodiversity as the source of biological resources: a new look at biodiversity values" (1997):

"An essential environmental condition is not something to be traded-off against more attractive, short-term opportunities. If an environmental condition really is essential, then it needs to be maintained. Land-use and land-management decisions should be made with this constraint in mind. Put simply, this means that each generation needs to live within its ecological limits. Each generation should be free to make whatever environmental trade-offs are appropriate for promoting the public interest, provided that biodiversity is not depleted. Or to express this as an ethical principle: *the conservation of biodiversity should take priority over any one generation's collective interests.*"

In summary, with the Resource Management Area Alternative, the Band and individuals owning a share in an allotment may not benefit economically in the short-term. The benefits of this comprehensive resource management plan are the protection of biodiversity and long-term ecological health, which cannot be traded for short-term economic gain. The continued healthy functioning of ecosystems and the long-term

sustainable management of natural resources, indeed the very source of natural resources, depends on biodiversity. In the conservation of biodiversity, the Bad River Band of Lake Superior Chippewa is managing its resources with an appreciation of its obligation to the next seven generations.

### **Forest Preservation Alternative**

Designating the entire Bad River Reservation as a Conservation Area is an alternative that is not recommended by the ID team, as it is too restrictive. The benefits of this alternative are that it would meet the goals of the IRMP and would provide better protection of all natural resources than the recommended alternative of designated Resource Management Areas. The costs, however, are not acceptable, since all timber harvest would be prohibited. The Band recognizes the need for balance between resource preservation and economic growth. Profits from the sale of timber on trust, allotted, and fee lands are used to purchase alienated land on the Reservation and fund part of the timber program, including tree planting. Without some income from timber sales, funds for land acquisition would have to come from somewhere else within the Band's budget. While natural resources would receive the highest degree of protection under this alternative, timber sales in some areas of the Reservation are desirable to provide funds for land acquisition and for the general economic needs of the community.

### **Timber Production Alternative (Status Quo)**

Prior to initiation of the IRMP planning process, timber harvest occurred throughout the Reservation without consideration for the cumulative impact of logging on the functioning of the ecosystem. Essentially, the entire Bad River Reservation was a Timber Production Area, with the objective being to maximize profit for the Band and allottees. Most of the Reservation was managed for aspen pulp, as aspen was the dominant tree species to grow after the cut-over.

The benefits of this alternative are economic. It is less costly in the short-term to manage aspen forests for pulp than it is to begin to convert aspen forests to a mixed forest containing large pines. In addition, the short-term profits from timber harvest, primarily aspen, would be greater than that provided by the recommended alternative. In the Band's view, however, continuation of the status quo would not adequately protect all natural resources. Soil erosion was occurring, native biodiversity did not receive sufficient protection, management decisions were not being made at the spatial

and temporal scales required to preserve and improve the quality of resources for the Seventh Generation, and most important to tribal members, water quality was not adequately protected. For these reasons, the Band rejected the status quo and decided to write the IRMP.

The conversion of aspen forests to mixed forests containing large pines, as outlined in the Resource Management Alternative, is likely to offer a greater variety of potential economic gains to future generations than the maintenance of aspen forests. A diverse forest, managed on a long rotation, can provide valuable saw timber or veneer, such as maple, oak, and pine, should future generations decide to harvest it. Future generations may decide that a diverse forest containing large trees is more valuable to them if left standing than if cut. It is within our power, and it is our obligation, to give the Seventh Generation that choice.

# Matrix for comparing natural resources alternatives<sup>1</sup>.

	Relative degree to which alternative meets IRMP goals*				Potential Problems in adopting each alternative	Potential Benefits
	goal 1	goal 2	goal 3	goal 4		
Alternative 1** (recommended)	-----   -----   -----   -----				<ul style="list-style-type: none"> <li>- Short-term economic gains from timber harvest not maximized</li> <li>- Band may have to compensate allottees for loss of timber revenue on lands in buffer and reserve areas, or face possible lawsuits</li> </ul>	<ul style="list-style-type: none"> <li>- Intrinsic values of biodiversity, water quality, etc. are protected</li> <li>- Long-term ecological health protected</li> <li>- Long-term economic gain possible</li> <li>- Some income generated through timber harvest</li> </ul>
Alternative 2 (preservation)	-----Δ   -----Δ   -----Δ   -----Δ				<ul style="list-style-type: none"> <li>- No income generated from timber harvest</li> <li>- Band may have to compensate allottees for loss of timber revenue throughout the Reservation or face possible lawsuits</li> </ul>	<ul style="list-style-type: none"> <li>- Provides the highest protection of natural resources</li> <li>- Long-term ecological health protected</li> </ul>
Alternative 3 (timber)	Δ-----   Δ-----   Δ-----   Δ-----				<ul style="list-style-type: none"> <li>- Resources not protected</li> <li>- Possible lawsuits from members regarding lack of adequate resource protection</li> </ul>	<ul style="list-style-type: none"> <li>- Short-term economic gain from timber harvest</li> </ul>

Explanation of Scale: Degree to which Alternative addresses IRMP goals.

|Δ-----| = Low, goal not addressed adequately;

|-----Δ-----| = Medium, goal partially addressed,

|-----Δ| = High, goal addressed well

\* IRMP Goals (see page 5)

- 1) Protection and improvement of water quality
- 2) Protection and enhancement of native biodiversity
- 3) Protection of ecosystem integrity
- 4) Protection and improvement of the quality of resources for the Seventh Generation

\*\* Alternatives (see pages 19-22)

- 1) Resource Management Area Alternative (Recommended)
- 2) Forest Preservation Alternative
- 3) Timber Production Alternative (Status Quo)

1 Disclaimer: In order for this document to be NEPA compliant, the BIA requires an analysis of environmental effects, which we provide in the matrix, above. We have not included an economic cost/benefit analysis of each alternative for several reasons. 1) It is impossible to quantify intrinsic values, such as ecosystem health, biodiversity, and protection of water quality and other resources. 2) Stumpage figures, typically available, rely on assumptions which change markedly over time. In addition, the exact future condition of the forests cannot be predicted; so an estimate of future stumpage values cannot be made. Hence, it is impossible to compare short-term economic gains or losses with long-term economic gains or losses. For example, if the Reservation is managed in a way that promotes conifer regeneration over aspen regeneration, the economic value of the future forests may be much greater than if aspen continues to be the focus of timber management throughout the Reservation. Without being able to compare short-term economic effects with long-term economic effects, we feel that any economic cost/benefit analysis is subjective and unfair.

## **DESCRIPTION OF THE BAD RIVER INDIAN RESERVATION**

The 125,000-acre Bad River Indian Reservation is located in parts of Ashland and Iron Counties, in northern Wisconsin (Figure 1, page 2). Approximately 77% of the Reservation is forested, 11% consists of wetlands and sloughs, and the remainder is covered by farmland, residential communities, and roads. The Reservation has approximately 40 miles of Lake Superior shoreline, and over 100 miles of navigable rivers and streams flowing into Lake Superior via the Bad, White, and Kakagon Rivers. Approximately 200 acres of Reservation land are on Madeline Island, which is the only Apostle Island not included in the Apostle Islands National Lakeshore.

Total tribal enrollment is 6,284 people, with a resident population of 1,199 (Indian Service Population and Labor Force Report 1995). The current resident population level represents an increase of nearly 50% since 1980. Four of the five largest areas of population (Old Odanah, New Odanah, Frank's Field, and Birch Hill Acres) are located along U.S. Highway 2. Diaperville is a small community located along Old Odanah Road.

As noted above, land ownership on the Bad River Reservation is highly fragmented, consisting of tribal trust (22,795 acres, or approximately 18% of the Reservation), allotted (36,900 acres, or approximately 30% of the Reservation), tribal fee (6,570 acres, or approximately 5.0% of the Reservation), and alienated lands (58,390 acres, or approximately 47% of the Reservation). The Treaty of September 30, 1854 established the original boundaries of the Reservation. Under previous treaties, lands reserved were held in trust for the Band as a whole. However, the 1854 Treaty authorized the President of the United States to allot 80-acre tracts to individual Band members for their separate use. On the Bad River Reservation about 97% of all tribal lands were eventually distributed in individual allotments. Some of these allotted lands were subsequently sold to non-tribal individuals. The end result is the current checkerboard nature of land ownership within the Reservation boundaries (Figure 2, page 4) that contributes to the difficulty in resource management.

### **CLIMATE**

The Bad River Reservation has a humid continental climate with four distinct seasons. The strongest climatic controls are the Reservation's mid-latitude location in the interior of the continent and its position on the south shore of Lake Superior. The westerly-

flowing upper atmospheric jet stream passes over the Reservation twice each year, moving north in the spring and south in the fall. This gives the Reservation long, cold winters dominated by continental polar air masses from northwestern Canada and the Arctic and cool to warm summers dominated by moist tropical air masses from the Gulf of Mexico. Because of its location immediately adjacent to Lake Superior, however, the Reservation's winter and summer climate are somewhat moderate compared to surrounding inland regions. Spring and fall are transition periods with frequent fronts moving through the area.

The mean monthly temperature in the Reservation area and the mean daily maximums and minimum temperatures for each month are shown in Figure 4. These climatic temperatures are calculated using the 1961-90 record (Owenby and Ezell 1992) for the four U.S. weather stations closest to the Reservation: Ashland Experimental Farm, 8 miles west; Gurney, 2 miles east; Madeline Island, 8 miles north; and Mellen, 7 miles south. Mean monthly temperatures are below freezing for 5 months, November through March, and the mean monthly minimum temperature is below freezing for April as well. The highest mean monthly maximum temperature is 79°F in July.

Although the mean monthly temperatures and precipitation data (Figure 4) are useful in characterizing the Reservation's climate, weather conditions on any given day can deviate widely from these climatic norms. Since 1952, the highest recorded temperature at all four regional stations is 103°F at Ashland in 1988; the lowest recorded temperature is -46°F at Mellen in 1996 (Midwest Climate Information System 1998).

Within the Reservation, the daily and annual temperature range increases from north to south because of the moderating effect of Lake Superior on lakeshore climate and the increase in elevation and gradient at the Reservation's southern end. There is also a precipitation gradient on the Reservation: total annual precipitation and snowfall increase from the northwest to the southeast.

Average annual precipitation on the Reservation is 32.5 inches when calculated with 1961-90 data for the four weather stations (Owenby and Ezell 1992). Precipitation occurs in all months, with a maximum of 4.2 inches in August and a minimum of 1.0 inch in February (Figure 4). Between 1948 and 1993, annual precipitation in the region varied between Ashland's 19.94 inches in 1988 and Madeline Island's 48.74 inches in

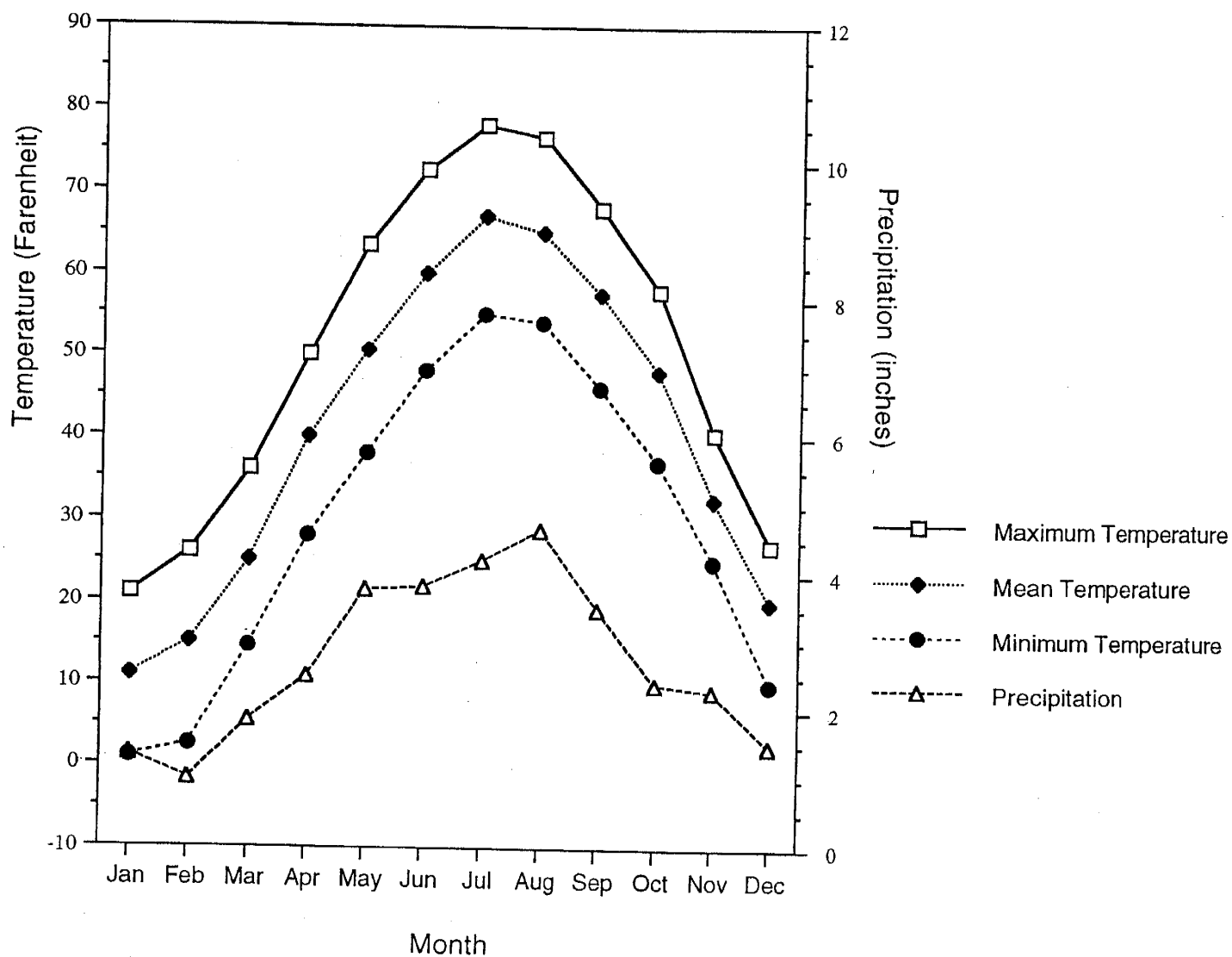


Figure 4. Mean monthly temperature and precipitation for the Bad River Reservation, based on 1961-1990 records from Ashland Experimental Farm, Gurney, Madeline Island, and Mellen. Mean daily maximum and minimum temperatures for each month are also shown (data from Owenby and Ezell 1992).

1991 (Midwest Climate Information System 1998). For the entire Lake Superior basin, annual precipitation variations are sufficient to affect the surface elevation of the lake (Phillips and McCulloch 1972), which has a direct impact upon the Kakagon and Bad River Sloughs.

Mean annual snowfall in the region ranges from 57 inches in Ashland and 60 inches on Madeline Island to approximately 137 inches at Gurney (Midwest Climate Information System 1998). In addition to this spatial variation, the annual amount of snowfall can vary widely from year to year as a result of frequent low pressure systems, cold Arctic air masses, and the extent of ice cover on Lake Superior. The wintertime lake-effect of Lake Superior, which causes high amounts of snowfall on the downwind side of the lake, exists on the east side of the Reservation but is not nearly as strong as it is farther east near Hurley, Wisconsin. The Northwestern Wisconsin Regional Planning and Development Commission (1974) estimated annual average runoff in the Bad River basin at 13.6 inches and annual evapotranspiration (water lost through evaporation plus transpiration by plants) at slightly higher than the regional average of 17.7 inches. Although these numbers cover a larger area, they provide reasonable approximations of runoff and evapotranspiration for the Bad River Reservation.

## TOPOGRAPHY

The topography of a region is the relief and shape of the land's surface. Topography is important not only because it provides clues about the region's earlier climate and geologic history, but also because it influences ongoing processes such as sediment production. Understanding the variations in a region's topography can lead to better management of a region's resources.

The Bad River Reservation lies entirely in the Superior Lowland, a physiographic region of low relief on the south side of Lake Superior and north of the Penokee-Gogebic Range (Figure 5). The Reservation's elevation rises from Lake Superior's mean surface of 602 feet above sea level to its highest elevation of more than 1,280 feet in the southeast toward the crest of the Penokee Range. The landforms within the Reservation are the result of glacial processes scouring the bedrock and reworking the loose sediments, producing a landscape dominated by a lowland clayey basin with numerous ravines, lakes and shallow wet depressions, and a rim of steeper landforms where the underlying bedrock prevented the ice from gouging. These sloping landforms are typically sandier and show evidence of many old remnant beachlines

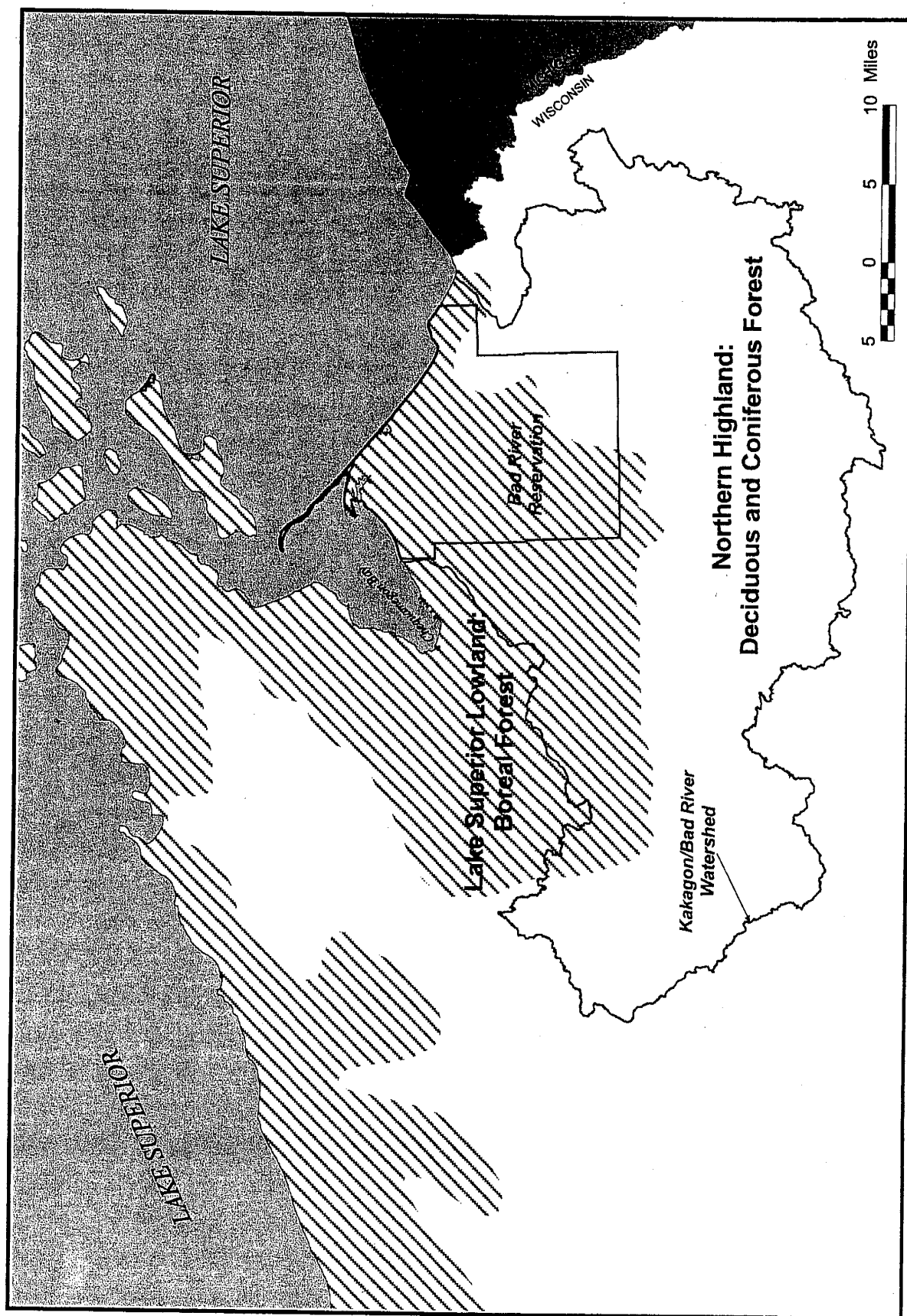


Figure 5. Lake Superior Physiographic Region

from higher lake levels, as melting glacial ice released huge volumes of meltwater that were periodically trapped in the Lake Superior basin.

Continental ice sheets covered northern Wisconsin repeatedly over recent geologic time, but few details are known about events prior to approximately 23,000 years ago. As glaciers advanced through the area now comprising the Bad River Reservation, the loose material at the bottom of Lake Superior was pushed onto the existing landscape. These lake sediments, having been repeatedly reworked by glaciers, contained a high percentage of very fine particles (i.e., clay), which was smeared onto the lowland basin of the Reservation. The fine clay was most likely waterlogged and highly fluid, resulting in a relatively level landscape. This landscape was then submerged by high lake levels during glacial melting; wave action further obliterated knobs and steep slopes, and silty and sandy sediments were deposited over the existing clayey landscape.

Repeated episodes of advance and retreat of glaciers has created the landscape we now see. Subsequent erosion due to rainfall and streams has modified the landscape by creating steep ravines and floodplains, and has slowly developed inter-connected drainage systems in the clayey deposits.

The ice receded about 11,000 years ago and re-advanced in a southwest direction about 10,000 years ago. This re-advance was followed by a final glacial retreat about 9,500 years ago. As the glacier retreated, the eastern outlet of Lake Superior was initially blocked by ice, causing meltwater to form a lake over a large area that included the areas now occupied by the Bad River Reservation. During this period, between 11,500 and 9,500 years ago, thick red clay and silt sediments were deposited on the bottom of this lake, which was up to 492 feet deeper than Lake Superior is today. When the ice retreated out of the east end of Lake Superior about 9,500 years ago, the level of the lake dropped to about 150 feet below its current elevation. With the weight of the ice removed, the Earth's crust began to rebound. The rapid uplift of Lake Superior's eastern outlet has caused the water level to rise gradually throughout Lake Superior. On the Reservation's shoreline, the lake level has risen about 1 inch every 10 years because of this differential uplift.

The summary of topographic features on the Reservation that follows is based on the more complete description by Clayton (1985) for the entire Superior Lowland. The most widespread topography on the Reservation is a "lake-modified glacial" surface

that is a flat to undulating landscape with elevations that increase gradually from about 620 to 800 feet above sea level. This region was under water following the glacial retreat. The sediments on these lowlands are intermixed red clayey till, silt, and clay lake sediment of the Miller Creek Formation. In the north-central part of the Reservation, low drumlins occur on the surface, oriented toward the southwest; they are typically about 0.6 miles long, 656 feet wide, and about 3 feet high (Clayton 1985).

The flat lowlands are dissected by widely spaced, narrow, steep-sided valleys that contain highly sinuous rivers and streams. Clayton (1985) described these valley side-slopes as being between  $10^{\circ}$  and  $15^{\circ}$ ; observations on the Reservation found the slopes to commonly exceed  $40^{\circ}$ , although it is not clear that these are the same slopes as those to which Clayton referred. Slopewash, soil creep, and landsliding formed these valley hillslopes. Slope deposits accumulating at the base provides the material to be carried downstream as sediments. Rivers and streams have created floodplains and terraces within the valleys which are now layered with thin sand and gravel deposits.

On the south and east fringes of the Reservation, where elevations and slope gradient are the highest, wave action during the high stages of the glacial lakes created wave-cut terraces and left beach deposits on the landscape. This wave action modified the glacial topography at elevations of about 886 feet and above. Several of these abandoned beaches and wave-cut bluffs exist on the Reservation northeast of Birch Hill, as well as a large area of sand deposited by the wind as dunes on top of the red glacial till.

The area of the Reservation generally north of U.S. Highway 2 is a flat region less than 610 feet in elevation consisting of open water, bog, and marsh. Here, the Kakagon and Bad River Sloughs lie in drowned valleys that formed when the surface level of Lake Superior was lower. As lake level rose, the valleys filled with stream sediment. The upper layer of sediment in the sloughs today is primarily organic. The sloughs also contain natural levees along the major rivers and streams, and ancient shorelines can be located parallel to Lake Superior. At the Reservation's far northern end, Oak Point and Chequamegon Point are composed of post glacial shoreline sediments deposited in the last few thousand years by current in Lake Superior (Bona 1990).

This concludes the general description of the Bad River Reservation. The next section contains descriptions of resources, along with goals and objectives for each resource. Resource topics included in this IRMP are soils, minerals, water, air, transportation, recreation, cultural, vegetation, wetlands, timber, fish, wildlife, and threatened and endangered species.

## **RESOURCE DESCRIPTIONS AND MANAGEMENT PLANS**

### **SOILS**

The Soil Conservation Service (now the Natural Resources Conservation Service, NRCS) completed a detailed soil survey of all tribal, allotted, and most alienated lands within the Bad River Reservation boundaries in March 1990. This soil survey identifies soil properties for land use suitability and limitations. Examples of these soil properties include: physical properties, such as soil texture, percent organic matter, and permeability; chemical properties, such as pH and shrink-swell potential; and engineering properties, such as stability and shear strength. The NRCS report highlights limitations and hazards inherent in the soil, suggests improvements to overcome the limitations, and discusses the impact of selected land uses on the environment. Details on soil properties and interpretations are available at the NRCS office.

Soil properties, at a regional landscape scale and local landform scale, provide many clues to understanding relationships among plant communities, hydrology, soil stability, and timber productivity. By examining these soil properties, it is possible to determine how different land uses may degrade the soil over time. The NRCS soil survey includes detailed information on suitable land uses for each soil type. For example, NRCS soil survey information on a soil type that is suitable for woodlands includes silviculture limitations (e.g., planting restrictions, seedling mortality, windthrow hazard, response to fertilizer), operability limitations (e.g., equipment limitations, soil depth and depth to bedrock, type of water table), and erosion hazards and soil compaction potential. The information contained within the NRCS soil survey on landforms and soils of the Bad River Reservation has been used in the drafting of this IRMP. Individual sites, however, must be evaluated in greater detail for specific development and resource use.

For this IRMP, the ID team worked with the NRCS to group soil types into natural landtype groups which serve as the basis for defining resource management actions. Landtypes provide coarse information on the properties, capabilities and limitations of different areas for broad-based land use planning. Six major landtypes occur on the Bad River Reservation: Upland Clay Plain, Steep Clayey Ravines, Upland Sandy Areas, Sloping/Stratified Sands to Clays, Coastal Wetlands, and Floodplains (Figure

6). These landtypes were formed by different geologic processes, derived from different materials, and have distinct landforms. They are distinguished from one another by different soil materials, vegetation, and hydrology. These landtypes are briefly described below.

### Description of Landtypes on the Bad River Reservation

#### 1) UPLAND CLAY PLAIN

Most of the Reservation lies in the upland clay plain, a broad, relatively flat landscape, where soils are typically red clay 5 feet thick or more. These areas are usually gently sloping convex landforms (2-6% slopes), lying between steep ravines. Some areas of the upland clay plain are essentially flat (<2% slopes), resulting in a mosaic of moderately dry and saturated soil conditions, with ponding of water in any minor depression. A shifting pattern of beaver impoundments occurs in these lowlands. Since the clay soils are very slowly permeable, rain water either ponds on the surface, evaporates, or moves into stream systems as surface runoff. Very little groundwater recharge occurs here. Most of the clay plain is currently covered in aspen forests.

Within the Upland Clay Plain landtype two soil types occur: Clayey Till and Fine Loamy Till, both described below.

*Clayey Till - Odanah, Sanborg, Badriver, Dagwagi Soils.* Clayey till areas are generally level to gently sloping, convex landforms with shallow depressional areas and steep, incised ravines. Soils are typically clayey (35-60% clay) with a thin, (3-10 inch) silty or loamy cap, and little or no surface organic matter. Slow permeability and perched water tables in swales and shallow depressions are typical of these areas. Soils typically occur in a complex pattern of moderately well-drained to poorly-drained areas. Often only a foot of elevation change separates these areas from one another.

*Fine-Loamy Till - Denomie, Gichigami, Oronto, Kakagon Soils.* Fine-loamy till landforms are mostly level to gently sloping, with soils more silty and less clayey than the clayey till areas (18-35% clay and <15% sand). Fine-loamy till areas, which occur east of Denomie Creek, have similar properties to clayey till, including low surface organic matter and perched water tables in shallow depressions.

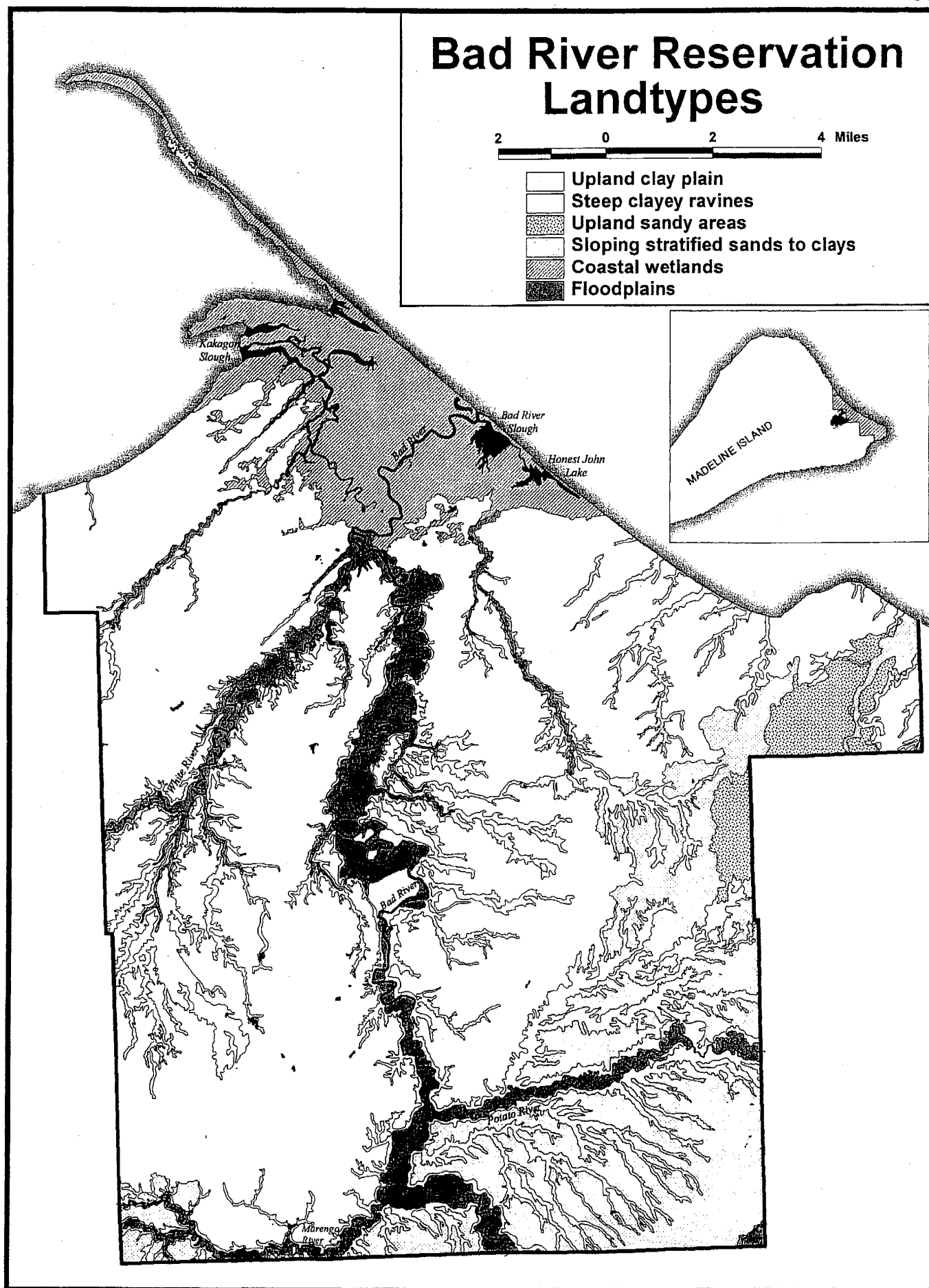


Figure 6. Landtypes on the Bad River Reservation

## 2) STEEP CLAYEY RAVINES

*Clayey Ravines - Udorthents ("young" soils lacking development).* Soils in these areas formed where streams have cut deep, narrow incisions into the clay. The slopes are very steep, typically ranging from 25-60%, and are relatively unstable, with slope caving and slumping common. Along the southern edge of the basin, these clayey soils are commonly underlain by stratified sandy and loamy materials within 40 to 60 inches of the surface. Slumping is particularly active in these areas due to undercutting of the looser sandy soils, which causes the overlying clay to collapse into the ravine. Sandy layers in this area may be conduits for groundwater recharge, further increasing susceptibility for slumping. These clayey ravines have a greater conifer component than other landtypes. Tree species diversity and age structure is also greater than in other areas due to less frequent historical fire events, difficulty in harvesting trees, and unsuitability for clearing or development.

## 3) UPLAND SANDY AREAS

*Sandy Outwash, Deltaic and Beach Deposits - Vilas, Sultz, Cublake, Croswell Soils.*

Upland sandy areas were formed along former shorelines of Lake Superior, when the basin was filled with glacial meltwaters. Birch Hill is the most prominent landform of this type on the Reservation, with other areas occurring on the sloping rim around the Bad River basin. The slopes in these sandy deposit areas are gently sloping to moderately steep. Glacial processes typically left deeper sand as beaches or deltas on upslope positions, resulting in recharge areas which supply cold groundwater to the headwaters of many streams on the Reservation. Rain water percolates into deeper soil layers until reaching finer-textured materials below the sands. It then moves laterally and comes to the surface as seeps in places where the sands thin out above the finer materials. Upland sandy areas currently support primarily pine, oak, and birch forests.

## 4) SLOPING STRATIFIED SANDS TO CLAYS

*Transition Soils (beach deposits, sands, fine sands and silts over clay, or clay over sands and silts) - Kellogg, Bohemian, Alcona, Portwing, Sarona, Michigamme Soils.*

Moderate to steep sloping landscapes lying adjacent to the clayey basin rim define these transition soils. The farthest southern extent of clay is characterized by thin clayey till (typically 1 to 4 feet thick) interlayered with outwash and lake sediments. These materials were reworked by wave action when the lake was at a higher elevation than at present. Minor areas of loamy and sandy tills with bedrock are also present in

the transition soils. This area has numerous seeps and springs, where subsurface water flow from upslope landscapes comes to the surface, forming the headwaters of many tributaries running into the Bad River system. The transition soils are typically downslope from the sandy beach and deltaic deposits described above. This landtype, which occurs in the southeast part of the Reservation where the high ridge of the Penokee Range slopes down into the clayey basin, is the only area that supports an upland sugar maple-basswood forest.

#### 5) COASTAL WETLANDS

*Organics, Wetlands - Cathro, Seeleyville, Rifle Soils.* Primarily found in the Kakagon/Bad River Sloughs, these wetland areas consist of thick organic material, generally underlain by fine sands, with thin layers of silts and clays. This layering occurs because of the landscape position at the mouths of streams and the continually saturated conditions that prevent decomposition of dead plant matter. In some areas, large interior depressions occur within the broad, flat clay landscapes, often consisting of shallow to moderately deep organics over clay. The vegetation of the coastal wetlands is typical of a peatland/marsh complex, with alder, sedges, and stunted tamarack in the peatlands, and pickerel weed, cattail, and other aquatic plants in the marshes. Coastal wetland sloughs, especially the Kakagon Slough, provide excellent habitat for wild rice.

#### 6) FLOODPLAINS

*Alluvial Soils (floodplains) - Moquah, Gander, Dechamps Soils.* This soil type occurs in the floodplains of the Bad, White, Potato, and Marengo Rivers, where level landscapes are subject to flooding and high water tables. Soils are variable, typically consisting of stratified sands, fine sands, and silts, but may occasionally be gravelly or clayey. These areas are generally rich in organic matter, and support lowland hardwood forests consisting primarily of sugar maple, silver maple, boxelder, and basswood.

#### Issues

- Extensive logging and subsequent fires around the turn of the century have significantly altered the landscape. The 2-6 inch duff layer on top of the soil was burned off. The altered hydrologic characteristics of the landscape may have accelerated the erosion process of Reservation soils.

- Construction activities and some present-day forestry practices may exacerbate soil erosion on the Reservation, especially in Watershed Protection and Restoration Areas.
- Conflicts occur between housing location and forest management, because housing development has tended to concentrate on soil areas that are well-suited for pine production.
- The alluvial soil areas on the Reservation are a potential source of topsoil and fill for construction projects. The red clay soils are considered an ideal material for building sanitary landfills. Currently the Band has no policies regarding the extraction of soil from one area of the Reservation for use in construction projects in other areas.
- Soil conditions have direct impacts on site suitability and costs associated with housing developments. The Band must consider such issues as soil suitability for roads, foundations, septic, erosion potential, and off-site effects of runoff. Prior to development projects, Comprehensive planning, including evaluating site potential, is necessary if soil related problems are to be avoided.
- Generally, the soils in the red clay area are not prone to leaching. Permeability of red clay soils is very low, for example 0.06-0.2 inches/hour for Sandborg-Badriver soils. Because these soils are so impermeable, the creation of a so-called 'bathtub effect' may become a concern in abandoned landfill sites. A landfill capped improperly, or a landfill capped with inadequate soils, could conceivably fill up and discharge in the form of a surface flow leachate. Soils in a landfill site may not consist of a homogeneous clay material (e.g., where sand was interbedded as the soils were deposited by glacial action). A landfill that transects these buried sand lenses may provide a conduit for leachates. All potential toxic landfill sites must be examined thoroughly for soil composition. Soil investigations surrounding a site will help characterize soil conditions and determine potential for off-site ground or surface water contamination. Remedial measures may be necessary for sites suspected of leaching. Installation of monitoring wells and construction of an impermeable cap constructed from soils suitable for that purpose may be appropriate.

### Goal

Realizing that different soil types have properties that make them better or less suited for different land uses, minimize soil loss and promote proper land use activities by basing decisions on soil survey information.

### Objectives

- Use the soil survey information for basic land use planning, resource management, and decision-making on the Reservation.
- Complete soil mapping on alienated lands within the Reservation.
- Finalize Bad River Natural Resources Department best management practices (BMP) guidelines (currently in draft form) to prevent soil erosion.
- Conduct field visits to determine site-specific soil properties prior to development of management actions.
- Develop a policy regarding the extraction of soil (for example, topsoil and clay) from the Reservation for use in construction projects, both on and off Reservation.

## **MINERALS**

### Description of Bad River Reservation Mineral Resources

The Reservation is underlain by rocks of Keweenawan age which are the youngest units in the Precambrian of Wisconsin. Mafic and felsic volcanic rocks are in the extreme southeast corner of the Reservation and are covered by younger sedimentary rocks of the Oronto and Bayfield groups. The entire Reservation (except for a low ridge in the extreme southeastern corner) was covered by ancient Lake Duluth.

The Keweenawan rocks were deposited in horizontal layers, but shortly after deposition were downbowed to form the Ashland Syncline. The south limb is steeply inclined whereas the north limb is gently inclined. Glacial lake clays of mixed mineralogy overlay these deep geologic deposits and cover the entire Reservation, except for the hilly area in the southeastern corner. These clay soils are predominantly red, tough and plastic, and usually contain high concentrations of calcium carbonate.

The U.S. Geological Survey (USGS) and the U.S. Bureau of Mines (USBM) completed a general survey of mineral resources of the Indian Reservations of Northern Wisconsin in 1976 (Cannon 1976). The report compiled and summarized available information on the geology, mineral and energy resources, and potential for economic development on certain Indian lands. Sources of information included published and unpublished reports, but were not supported by field investigation.

Findings of the USGS and USBM report include information on both metallic and non-metallic minerals on the Bad River Reservation. The Gogebic range, which contains iron ore, passes along the southeast corner of the Reservation. The ore in this deposit, however, is too deep to be mined profitably at this time. The southeast corner of the Reservation also contains copper ore, though the potential for copper mining on the Reservation is low due to the low grade and small amount of the ore. Clay, peat, sand, and gravel are the nonmetallic minerals on the Reservation. Clay may be suitable for bricks, pottery, and lining for landfills or sewage treatment lagoons. Peat, which occurs on the Reservation in the Kakagon/Bad River wetland complex north of U.S. Highway 2, is mined in some parts of the world (including Wisconsin) and used for energy production as well as for soil conditioning. Sand and gravel deposits occur on the Reservation, though are not readily accessible. Unless mineral demand and prices change dramatically, it is not anticipated that there will be a demand for the type of mineral resources contained in the Bad River Reservation.

### Issues

- No major exploitation of mineral resources has occurred on the Bad River Reservation to-date, and the probability of future exploitation remains low. If oil or mineral exploration or extraction ever did occur, the environmental concerns would be many (e.g., ground and surface water contamination, air pollution).
- Though mining of peat in the large wetland complex north of U.S. Highway 2 (Kakagon Slough, Bad River Slough, Honest John Lake) has not been proposed, such activities could seriously damage this fragile ecosystem.
- Currently the Band has no policies regarding reclamation and restoration of lands affected by oil or mineral exploitation.

### Goal

Protect the quality of the environment in the event of exploration and extraction of mineral resources on the Bad River Reservation.

### Objectives

- Develop a policy to minimize environmental degradation during mining activities, should they occur on the Bad River Reservation.
- Adopt an ordinance which protects the Kakagon/Bad River Sloughs complex from peat extraction.
- Develop a policy of reclamation and restoration of any site affected by mineral exploration or extraction on the Bad River Reservation.
- Develop a strategy to address issues resulting from mining off-Reservation, but within the Bad River watershed, should such mining occur.

## **WATER**

Although the water quality on the Reservation is relatively good, it cannot be considered pristine due to the various anthropogenic (human-made) sources of pollution which act to degrade the water quality within the Bad River watershed. Some of these pollution sources include: municipal wastewater discharges; failing septic systems; runoff from agricultural land; land uses that increase erosion of stream banks and exposed slopes; leaking underground storage tanks (LUSTs); abandoned and active landfills, solid waste dumps, and junkyards; hazardous waste dumps; air-borne contaminants; and illegal dumping.

### **Groundwater**

#### Description of Bad River Reservation Groundwater Resources

Tribal community water supplies (community wells) are taken mostly from the Precambrian sandstone aquifer, from 90 to over 180 feet deep. These aquifers are confined by thick layers of clays from previous glacial lakes, 30 to over 150 feet deep, which cover much of the Reservation. Sand lenses or sand pockets can be found in the clay layer. In the Bad River floodplain, tilted rockbeds of shales, slates and

sandstones, intermixed with lava flows, have been exposed, and in some areas, these layers are almost vertical. Some of the tilted rock layers that contain water have resulted in the artesian wells found on the Reservation.

The groundwater quality is generally good, however, recent testing by private consulting firms in 1994-96 showed levels of several metals slightly below or slightly above Wisconsin Preventative Action Levels (PAL). When a contaminant reaches concentrations equal to PAL, action must be taken to lower its concentration, even though it may not yet pose a human health risk. Arsenic and barium were found in several wells just below PAL. Lead and chromium were found in several wells slightly above PAL but generally below federal maximum contaminant limits (MCL). The arsenic and barium appear to be background levels, though the BRNRD is currently investigating naturally occurring levels in the soils of the area. Lead contamination is unfortunately all too common throughout the United States. Lead from plumbing fixtures, solders, and submersible pumps can contaminate drinking water. In 1984 the State of Wisconsin banned the use of lead solder in plumbing. The federal government followed suit in the 1986 amendments to the Safe Water Drinking Act. Any plumbing installed before 1984, however, is likely to have lead solder.

### Issues

- A few of the sand pockets within the clay layer have been excavated and used as borrow pits. Two of these excavations were used as dumpsites for paper mill waste sludge during the period from 1968 to 1979. Concerns over the possibility of contaminated water supplies from this paper sludge dumpsite on the Reservation have led to a great deal of sampling and testing of private and municipal wells in the Old Odanah and Diaperville areas for various compounds associated with the sludge. Although most of the recent testing does not indicate contamination problems at local drinking water wells, these concerns will persist until actions are taken to remediate this and other sludge dumpsites on the Reservation. A "Phase I Environmental Screening Investigation" has been completed (Geraghty and Miller 1996) by one of the potentially responsible parties (PRP), to determine the extent and degree of contamination from the County Highway A and the Government Road paper sludge sites. An ecological assessment of the County Highway A site is scheduled for the 1997 field season. Based upon this determination, the PRP, the Band, Ashland County, the Wisconsin Department of Natural Resources (WDNR), and the U.S. Environmental Protection Agency (USEPA) will negotiate to remediate these sites.

- Other sources of groundwater contamination are improper disposal of used motor oil and leaking underground storage tanks (USTs).

### Current Status

The BRNRD is currently creating a database of wells on the Reservation as a result of concerns regarding contamination from the paper sludge dumpsites. While these data provide a brief picture of the groundwater quality of the area, a clear description of the hydrologic properties of the Reservation, such as groundwater flow characteristics, surface/groundwater interface, and water table contours, is still needed. A joint groundwater characterization study between the U.S. Geological Survey (USGS) and Bad River began during the 1998 field season to add to this information. Some of the available data can be used in further efforts to perform a comprehensive water study on the Reservation. The Indian Health Service (IHS) has information available for most of the more recent wells on the Reservation. The Band can ultimately use this information for a well-head protection plan.

Although there are enforceable drinking water standards, as provided in the Safe Drinking Water Act (SDWA), there are currently no federal groundwater standards. Rather, states and tribes were encouraged to develop their own groundwater protection strategies. However, the Band has not yet developed groundwater standards, and the application of State of Wisconsin standards on the Reservation is limited.

Tribal water supply technicians currently submit water samples from community wells to the State Laboratory of Hygiene in Madison for analyses of various parameters on a schedule regulated by the USEPA. Currently the utility has received waivers for sampling for the required organic contaminants, which means they will be analyzed for PCBs, pesticides, and other common contaminants only once every three years. This applies to the Odanah, Birch Hill, and Diaperville community wells. Additionally samples are analyzed for metals, nitrite, nitrate, fluoride, chlorine, and coliform bacteria.

Underground storage tanks (USTs) can pose an enormous threat to water quality if leaks develop. The BRNRD is currently conducting an inventory of all USTs on the Reservation, and is working with the USEPA to verify location of the tanks. Federal

statutes require the updating or removal of all USTs by December 1998. State or federal funds may be available for spill remediation and tank removal.

### Goal

Protect and improve the groundwater quality on the Bad River Reservation. Prevent future negative impacts to groundwater quality.

### Objectives

- Continue and expand ongoing lead education efforts and investigations into groundwater quality.
- Develop strategies to acquire more baseline groundwater quality data. Continue to analyze and interpret water quality data.
- Include groundwater protection and enhancement in future efforts to establish tribal water quality standards.
- Develop tribal codes for private septic systems (currently there are no regulations that apply).
- Designate Wellhead Protection Areas, pursuant to the Safe Drinking Water Act, for those community water supply wells that should be protected against various sources of contamination. Funding for this is available through the USEPA and the BIA Water Resources Program.
- Develop a Sole Source Aquifer Program which would limit the amount of federal involvement for projects that may impact the designated aquifer. This program may help the Band protect its main drinking water aquifer from future threats.
- Identify and remove all old USTs to bring the Reservation into compliance with federal regulations and prevent potential groundwater contamination.
- Identify open unused wells that may act as a conduit for land surface contaminants to groundwater and properly close such wells.

## **Surface Water**

### Description of Bad River Reservation Surface Water Resources

The surface waters of the Reservation are generally of good quality and support a variety of fish known to be relatively intolerant of pollution including walleye, trout, and sturgeon. The terms "point source" and "non-point source" are used to describe the various sources of pollution that normally affect surface water resources. Point sources include wastewater discharges and other pollution sources that can be traced to an outfall pipe or other such definite source. Pollutants that can be picked up and moved as water moves over and through soils are generally called non-point sources. Examples of non-point source pollution include runoff from agricultural fields and roads, failing septic systems, and increased erosion of stream banks and steep slopes due to poor land use practices (e.g., agriculture and clearcutting adjacent to streams and slopes). Chemical loading is also a potential threat from barnyard runoff and agricultural chemicals applied off-Reservation.

Current wastewater treatment systems on the Reservation utilize both single and multi-celled lagoons and a sequencing batch reactor. Tribal Wastewater Technicians sample and test the wastewater for total suspended solids, biological oxygen demand, nitrogen, phosphorus, and fecal coliforms before discharging treated effluent into the environment. A National Pollution Discharge Elimination System (NPDES) permit is maintained with the USEPA to continue to operate these treatment systems.

Water quality tests performed by tribal environmental staff on Denomie Creek downstream from the former New Odanah lagoons were reported to have low levels of dissolved oxygen after discharge of treated effluent in 1994. Low levels of dissolved oxygen are one indication of water quality degradation. Various wastewater treatment options were then considered to handle the wastewater generated by the New Odanah Community as well as future and on-going housing and commercial development projects. A new facility was constructed in 1995, called a sequencing batch reactor (SBR), which incorporates a series of batch tanks and is capable of processing a much greater amount of wastewater to a higher degree of quality than the previous lagoon system. This facility currently services the New Odanah and Frank's Field communities, while lagoons are used for the Diaperville and Birch Hill communities.

### Current Status

Although a great deal of tribal and federal resources have been used to assess the quality of the drinking water on the Reservation, there is very little information available regarding the surface water quality of the Reservation. The USGS maintains a stream gauge station on the Bad River that supplies gauge height and discharge information. More data are needed to characterize the water quality of all the streams on the Reservation to enable resource managers to assess the problems, remedial alternatives, and designated uses of each. The BRNRD initiated a surface water monitoring program in 1997, which will generate the basic ecosystem health data needed by resource managers.

The first year of water quality monitoring by the Band indicates generally good water quality which is, however, receiving some point and non-point source pollution impacts. Fecal coliform bacteria counts are often high downstream of several rural communities, indicating municipal wastewater may not be treated effectively or private septic systems may be failing both on and off Reservation. Soil erosion into streams and rivers tends to be high. Many farms in the watershed allow their livestock access to the streams, which increases sedimentation and possible fecal coliform counts.

These and other impacts to water quality of the entire watershed were described in the Band's Watershed Assessment under the Clean Water Action Plan in the fall of 1998. Issues including fish consumption advisories, biological system disturbances (e.g., invasions by exotic species), land use practices and their impacts on erosion, concerns over groundwater quality and wastewater treatment, indicate that the waters of the Bad River watershed may no longer be considered pristine.

Funding received in 1998 from the USEPA will allow testing of surface water, sediment, and groundwater on the Reservation for analyses of metals, mercury, pesticides, PCBs, and dioxin/furans. Such information is currently not available on the Reservation. In addition, the BRNRD initiated a macroinvertebrate sampling program in 1998 to assess the biological indicators of water quality.

The federal Clean Water Act sets up various overlapping methods of controlling water quality in all of the waters within the United States. One of these methods is the establishment of Water Quality Standards by states and tribes. Water Quality Standards consist of designated uses for particular bodies of water, and narrative and

numerical standards that must be met in order to protect those uses. Federal permits for any activities, including discharges of pollutants into surface water and dredge and fill activities, may not be granted if they will cause a violation of a Water Quality Standard. Other water quality control methods consist of permitting requirements for discharges and funding non-point source pollution control projects.

Although the State of Wisconsin has adopted Water Quality Standards for use throughout the state, such State regulations are not valid on Indian land. However, the USEPA uses state Water Quality Standards to establish effluent limitations for all permits affecting Reservation waters if no tribal standards exist (see 54 Fed. Reg. 39,098, 39,104; 1989). The Band is currently in the process of drafting Water Quality Standards and preparing a Treatment as State application to the USEPA to make its standards enforceable on all waters within the Bad River Reservation.

The State has designated the Bad River Sloughs and Kakagon Sloughs as "Outstanding Resource Waters" (Wis. Admin. Code, NR 102.10; Aug. 1997). State regulations require that effluent discharges into Outstanding Resource Waters be as clean as the water in the waterbody itself. Although state regulations do not apply to Indian lands, presumably the USEPA would include a comparable requirement if someone applied for a permit to discharge effluent into the Bad River or Kakagon Sloughs.

The State has not given special designations to any other waters within the Reservation. Thus, if the USEPA receives a permit application for a discharge into other Reservation waters, it will apply the Wisconsin standards for "fish and aquatic life waters," which is the State's default category for waters without special designations. This means that even though Reservation waters may currently be cleaner than necessary to support fish and aquatic life, they may be degraded from their present quality (see Wis. Admin. Code, NR 207.04; Aug. 1997). The State has designated the White River upstream of the Reservation boundary as an "Exceptional Resource Water"; this designation also receives increased protection under Wisconsin's anti-degradation regulations. However, this extra protection does not apply to the portion of the White River within Reservation boundaries.

The Band does not recognize the State's authority to set water quality standards within the boundaries of the Bad River Reservation. The designation of the Bad River

Slough and Kakagon Slough as State "Outstanding Resource Waters" was done without consulting the Band. The State currently does not monitor water quality in the Sloughs in support of their designation, nor does the Band recognize the State's authority to do so. Furthermore, most Reservation waters are currently less protected than other comparable waters within the State of Wisconsin under the State's regulatory system. It is thus imperative that the Band establish its own Water Quality Standards and receive Treatment As State status in order to protect the waters of the Bad River Reservation.

### Goal

Protect the quality of near pristine surface water on the Bad River Reservation and improve the quality of those waters impacted by point and non-point source pollution.

### Objectives

- Establish tribal water quality standards, as provided under Section 303 of the Clean Water Act. These standards would allow the Band to designate uses, including designating Outstanding Resource Waters for the streams and lakes on the Reservation. Funding may be available through the USEPA and the BIA to assist in the development of these standards.
- Develop a tribal non-point source management plan. This plan could help identify significant non-point sources of pollution and plan to minimize the effects from these sources. Public education will be an important component of such a plan. Funding may be available through the USEPA.
- Develop tribal codes for septic systems.
- Visit sites of proposed timber harvest and provide recommendations for protecting surface water quality at each site.
- Continue the water quality monitoring program.

## **Pesticide and Herbicide Use**

"...we should no longer accept the counsel of those who tell us that we must fill our world with poisonous chemicals; we should look about and see what other course is open to us."

Rachel Carson

Pesticides and herbicides are commonly used in agriculture, forestry practices, roadside maintenance, railroad and power line right-of-way maintenance, lawn and garden care, and control of exotic species. The surface and groundwater quality on the Reservation may be affected by pesticide and herbicide application both on and off the Reservation. Additionally, airborne residues from pesticides can travel thousands of miles and be deposited in soil and surface water, including Lake Superior.

Each year the population of the United States uses approximately 3 billion pounds of pesticides and herbicides. Numerous studies have linked these chemicals, which contain at least 107 cancer-causing active ingredients, to such human health problems as nerve damage, dizziness, acute nausea, genetic damage, birth defects and many cancers including leukemia (Rosenthal 1993). Pesticides and herbicides have had an equally devastating effect on wildlife. Many bird species, including the bald eagle, came near to extirpation in the lower 48 states due to the thinning of eggshells caused by the use of DDT in the late 1940s and 1950s. (Tribal elders recall the federal government's extensive use of DDT for fly control in homes and buildings on the Reservation during this period.) Although the federal government banned the use of DDT and several other pesticides in 1972, both residuals (those toxins remaining in the ecosystem) and air deposition from other nations continue to affect the Reservation. (The U.S. government banned the use of DDT even though it is still produced in the United States and exported to other countries, and produced abroad. Ironically, the use of DDT in other countries results in airborne deposition of DDT in the Great Lakes.) A recent analysis of fatty tissues from eight otters living on the Reservation revealed the presence of DDE, a substance produced when DDT enters an animal's body and is broken down into forms other than the original chemical. It is unclear whether this DDT came from deposition in the 1940s and 1950s or is from much more recent airborne sources.

Currently, the Bad River Forestry Program does not use herbicides for site preparation, release treatments, or thinning of tribal forests. This practice should be applauded and

encouraged throughout the Bad River watershed. At this time it is unclear what applications are made on roadsides or along right-of-ways or in private lawn care and gardening. The BRNRD is working with the U.S. Fish and Wildlife Service (USFWS) to control the sea lamprey population in the Bad River. Although the best control method is currently a lampricide known as TFM, both the BRNRD and the USFWS are seeking alternatives to this chemical control. Similarly, the BRNRD is currently using an herbicide for purple loosestrife control, but is seeking a less invasive manner of controlling this aggressive exotic plant.

### Goal

Discourage the use of pesticides and herbicides and encourage the use of biological controls for insect pests and nuisance plants on the Bad River Reservation.

### Objectives

- Provide information to the tribal community about the potential health and environmental effects of pesticides and herbicides.
- Research the amounts of pesticides and herbicides used on the Reservation, along roadsides and right-of-ways, as well as in lawn care and gardening.
- Hold hands-on demonstrations of alternative methods of insect and plant control, native plant landscaping, and integrated pest management.
- Organize a seminar on traditional Anishinabe gardening and insect control techniques.
- Support national and international efforts to ban the production and use of the thirteen most toxic pesticides and herbicides (known as the dirty dozen).

## **AIR**

### Description of Bad River Reservation Air Quality

The air of the Reservation is of good quality although it would be difficult to classify as pristine. Emissions from power companies, industry, automobiles, landfills, wood burning stoves, refuse burning barrels, and dirt roads have affected the Reservation's

air resources. Air pollution on the Reservation can come from sources within the boundaries of the Reservation or from sources hundreds, even thousands of miles away, making air quality resources among the hardest to visualize, measure, and regulate. This regulatory difficulty, however, should not stop continued and increased protection of this resource.

Air quality on the Reservation is affected by deposition and accumulation of air toxics, such as mercury and DDT, and air pollutants such as particulate matter. Particulate matter are tiny pieces of materials such as wood smoke or road dust that can be inhaled but not exhaled, increasing both the occurrence and severity of sinus infections, allergies, asthma, and respiratory diseases. These materials are of concern in rural areas from such sources as wood burning, refuse burning, and dirt roads.

Both air toxics and pollutants affect human health and the environment. Air toxics can accumulate in the tissues of animals - called bioaccumulation - sometimes killing the animal or often causing neurological damage. These toxics, such as mercury, can also be concentrated as they are passed up the food chain as, for example, when big fish eat smaller fish. This is called bioconcentration and results in dangerously high levels of toxins in animals high in the food chain. Fish that are high in the food chain (e.g., walleye) have become so contaminated by mercury from air deposition that subsistence fishing is no longer safe in some areas of northern Wisconsin. In a recent study, the germination and early growth of wild rice was also shown to be severely affected by low levels of heavy metals like lead and mercury (Lee 1996, unpublished data).

Air quality is classified in two ways: the first is according to the National Ambient Air Quality Standards (NAAQS) determined by the USEPA. A region is in attainment if all of these standards are met, or non-attainment if one or more are exceeded. Air that is in attainment is further designated as Class I, Class II, or Class III, depending on how much degradation of air quality is allowed. Class I allows only a moderate amount of degradation and Class III allows the most. The remaining air, including that of the Bad River Reservation, is considered Class II. Currently Class I regions include many national parks and wilderness areas. To gain further protection for air quality, tribes and states have the right to redesignate air from Class II to Class I. The Band has produced a document which analyzes the social, economic, and ecological effects of such redesignation on the Reservation and in surrounding areas.

### Issues

- Current air quality on the Reservation is not monitored adequately.
- No provision exists to protect the air quality on the Reservation from future degradation. Protection of future air quality requires taking steps now to prevent threats such as construction of waste incinerators near Reservation boundaries from becoming a reality.
- Air quality codes for the Reservation currently do not exist.

### Goal

Protect and improve the quality of air resources on the Bad River Reservation.

### Objectives

- Work with other tribes and agencies to obtain air monitoring data for the region.
- Establish a monitoring system for mercury and total suspended particulate matter.
- Redesignate the Bad River Reservation to Class I under the prevention of significant deterioration provisions of the Federal Clean Air Act.
- Work with international efforts to reduce air emissions in both the United States and Canada.
- Examine methods of controlling and reducing local sources of pollution in order to improve existing air quality.
- Establish tribal air quality codes.

## **TRANSPORTATION**

Although transportation is not a natural resource, it is an important social resource that has the potential to affect natural resources in negative ways. The discussion of transportation included in this IRMP is focused on the potential effect transportation may have on natural resources.

### Description of Transportation Routes on the Bad River Reservation

Approximately 111 miles of roads exist on the Reservation, the current condition of which ranges from good to impassable. These roads can be categorized as:

Primary and secondary roads (paved), 24 miles

Light duty roads (gravel), 87 miles

Unimproved roads (forest roads, "two-tracks"), inventory incomplete

Several governmental entities are involved in the maintenance and construction of roads, including the towns of Sanborn, Ashland, White River, Gingles, Saxon, and Gurney; Ashland county; the State of Wisconsin; and the federal government via the Bureau of Indian Affairs and the Bad River Band. Each of these governmental entities has its own method for determining which roads need improvement and what funding is available. As of 1991, with the enactment of the Intermodal Surface Transportation Efficiency Act (ISTEA), these entities are required to cooperate in construction and planning efforts in order to use federal highway funds.

During the first half of the twentieth century, two active railroad lines serviced the Reservation. One of these lines has since been abandoned, while the remaining railroad line (at the south end of the Reservation) is used primarily to haul freight from Michigan's Upper Peninsula.

### Issues

- The condition of the railroad at the south end of the Reservation is cause for concern. Some sections of track are in a serious state of disrepair, with the potential to cause derailment. Since hazardous and toxic materials may be transported across the Reservation on these tracks, a derailment and subsequent spill of these chemicals could cause severe environmental damage.
- Hazardous and toxic materials are transported by truck across the Reservation on U.S. Highway 2. Again, the risk of a spill exists, which would jeopardize natural resources.
- Roads are a source of non-point source water pollution. Road construction and improvement projects in particular, may cause environmental damage.

### Goal

Protect the natural resources of the Bad River Reservation from degradation due to transportation-related projects.

### Objectives

- Establish policies to improve the construction, repair, and maintenance of railroad lines and highways and to decrease other transportation accident factors, in order to protect the natural resources of the Reservation.
- Study the environmental impacts of all proposed transportation improvement and construction projects. Involve the BRNRD in the decision-making and review process regarding such projects.
- Maintain roads to mitigate non-point source impacts on water quality.
- Establish a Memorandum of Understanding with alienated land owners within the Bad River Reservation to minimize the construction of new roads.
- Complete the Emergency Response Plan to facilitate protection of natural resources in case of a hazardous material spill.

## **RECREATION**

Although recreation is not a natural resource, it is included in this IRMP because of the potential negative effect development of recreational opportunities may have on natural resources.

### Description of Bad River Reservation Recreational Opportunities

Abundant recreation opportunities exist on the Reservation, including baseball, camping, hiking, hunting, bird watching, cross-country skiing, snowmobiling, ice skating, boating, fishing, canoeing, swimming, and all-terrain vehicle riding.

### Issues

- The growing population on the Reservation has and will continue to place increasing demands on socio-economic services provided by the Bad River Band, including recreation.

- All terrain vehicles (ATVs) can have serious impacts on Reservation soils. Heavily used trails destroy vegetation, compact soils, and cause serious erosion problems. Soils compacted by ATV traffic are difficult to revegetate and have a tendency to hold water. Particular attention to main trail lay-out is important to help prevent serious erosion and water quality problems in remote areas.
- The lack of designated snowmobile and ATV trails has led to widespread use of unauthorized trails throughout the Reservation, contributing to erosion problems and disturbing populations of some wildlife (e.g., turtles and goshawks).

### Goal

Protect the natural resources of the Bad River Reservation from degradation due to recreation pressures.

### Objectives

- Protect areas that are environmentally sensitive, unique in quality, and culturally significant. River banks, water falls, pictured rocks, Pow-Wow grounds, and traditional fishing camps are examples of areas that should be protected from degradation.
- Study the environmental impacts of all proposed recreation improvement and construction projects. Seek the involvement of the BRNRD in the decision-making and review process regarding such projects.
- Consider the designation of trails for recreational snowmobile and ATV use.

## **CULTURAL**

### Description of Bad River Reservation Cultural Resources

Cultural resources include archeological sites, burial grounds, sacred spiritual sites, and areas of traditional use, all of which are of great value to the Bad River community. Hunting, fishing, trapping, medicine gathering, berry-picking, wild-ricing, and sugaring are examples of traditional cultural activities enjoyed by many people on the Reservation.

The State Historical Society of Wisconsin has searched its records and provided the Band with a list of archeological and architectural sites within the Reservation boundaries. While this information is helpful, it is incomplete, and more information is needed on traditional use locations to protect these sites adequately .

### Issues

- As land modifying activities increase and change in scope on Reservation lands, it is expected that the demand for and value of traditional use areas and other cultural resources will increase. Surveys are needed to locate and assess conditions of cultural resources and traditional use areas. Currently a systematic inventory of these resources has not been completed.

- Anecdotal evidence suggests that berry and wild rice production has declined over the years. Traditionally, the rice beds were managed by weeding water lilies, pickerel weed, and other competitive plants from rice areas. Fire was used to improve berry production in some areas. Presently, little management occurs to improve the rice and berry crops.

- Some traditional use areas are known to have been heavily impacted by past logging activities and it is assumed that some archeological sites have likewise been damaged.

### Goal

Identify and protect all culturally significant areas and resources on the Bad River Reservation.

### Objectives

- Establish a Tribal Historical Office to protect the Band's cultural resources.

- Perform a thorough records search to locate data collected during previous cultural resource inventories on the Reservation.

- Consult with tribal elders, the Wisconsin State Historic Preservation Office, the Bureau of Indian Affairs, and previously contracted archeologists in order to identify historic traditional use areas and previously undiscovered cultural sites.

- Communicate with other Anishinabe Tribes to share cultural information and to work towards protection measures of cultural sites on and off Reservation.

- Ensure cultural resource surveys are conducted on sites scheduled for development projects and timber harvesting.
- Compile survey reports, site records, and maps of cultural resources and traditional use areas, and incorporate these data into the Band's Geographic Information System (GIS).
- Manage traditional berry-picking and wild-ricing areas to improve harvesting opportunities.

## VEGETATION

### Description of Bad River Reservation Vegetation Cover Types

The vegetation discussed in this section of the IRMP includes ground herbs, shrubs, and trees. Many plant species are important to tribal members for cultural reasons, including medicinal and ceremonial purposes. (Timber is discussed separately, beginning on page 72, with an emphasis on production and harvest.)

Plants tend to be associated in groups called vegetation types or cover types (or community types if one includes information on the fauna (animals), or habitat types if one includes information on both flora (plants) and fauna and emphasizes the physical attributes of the area). Vegetation types are associated with nutrient and moisture factors, and hence are related to slope and soil type.

The Bad River Band developed a vegetation classification system (Westad et al. 1993) based on the Minnesota Department of Natural Resources Natural Heritage Program's native vegetation community types (Minn. DNR 1993). This system of classification covers the entire Reservation and includes not only tree species but also the shrubs and ground flora characteristic of an area. Twenty-six cover types have been identified on the Reservation (Table 1). A map, which includes full descriptions of these vegetation cover types is available for viewing at the Bad River Natural Resources Department (BRNRD).

Table 1. Vegetation Cover Types on the Bad River Reservation.

Aspen Forest	Red Pine Forest
Aspen Clearcut	White Pine Forest
Aspen-Red Maple Forest	Spruce-Fir Forest
Aspen-Birch Forest	Upland White Cedar Forest
Sugar Maple-Basswood Forest	Tamarack Swamp
Northern Hardwood Forest	Mixed Conifer Forest
Silver Maple-Boxelder Forest	Swamp Conifers
Red Oak Forest	Upland Meadow
Red Oak-Red Pine Forest	Upland Brush
Red Oak-Aspen Forest	Alder Swamp
Boreal Hardwood-Conifer Forest	Willow Swamp
Black Ash Swamp	Sandbar Meadow
Mixed Hardwood Lowland Forest	Wet Meadow

### Issues

- The BRNRD initiated an inventory of State-listed rare plants within the Reservation. State-listed plants are those known or suspected to be rare in natural communities native to Wisconsin. The State list includes species legally designated as "endangered" and "threatened", as well as species in the advisory "special concern" category. While some rare species have been found on the Reservation, a search for other plants that are uncommon regionally but not included on the State list has not been completed. Tribal guidelines for the management of rare or regionally uncommon plant species currently do not exist. Please refer to the section on Threatened, Endangered, Rare, and Culturally Sensitive Species, beginning on page 98, for further discussion.
- Some plant species that have traditionally been collected by tribal members are less abundant today than they were in historical times, including blueberries, cranberries, birch, wild-rice, white cedar, balsam.
- An inventory of all plant species occurring on the Reservation does not exist.

- Commonly practiced industrial silviculture has proceeded without regard to the effects of logging and regeneration on understory plants. The effects of timber production on the understory plants in forest communities is unknown, as we do not have a record of the pre-logging herbaceous vegetation. Timber production has been the primary land based activity on the Reservation since the cut-over at the turn of the century.
- High populations of deer on the Reservation may have a negative impact on the reproduction of some plants, such as hemlock, Canada yew, white pine, white cedar, lilies, and orchids. The large amount of young aspen on the Reservation contributes to the high abundance of deer.
- Threats to plant communities in wetlands include exotic invasions (e.g., purple loosestrife, narrow-leaf cattail, giant reed grass, Eurasian milfoil), increasing nutrient enrichment, and general displacement of native plant communities through increasing development.

#### Goal

Maintain the level of vegetation diversity (at all scales) that exists today within the Bad River Reservation, and try to increase the level of landscape diversity (e.g., restoration of boreal forests in some areas). Manage the vegetation resource in a way that provides for a sustainable level of harvest of collectable plant species and continued abundance of all plant species.

#### Objectives

- Concentrate plant community and rare species inventory work in Conservation Areas and Watershed Protection Areas, where uncommon community types are most likely to occur.
- Continue research on nutrient enrichment of wetlands in Conservation Areas.
- Monitor and control exotic species, especially in Conservation Areas and Watershed Protection Areas.
- Start an herbarium for the Reservation, so that there is a permanent record of plant species found on the Reservation for the benefit of future research and understanding.
- Complete a Flora of the Reservation.

- Involve the Bad River school with the collection and identification of plants.
- Re-assess the wild-rice resource to understand changes over a 7-8 year period, as changes over this amount of time reflect more than natural year-to-year fluctuations.
- Monitor deer forage activities relative to certain areas, certain plant species, or both.
- Monitor the effects of various timber management practices on understory plants.
- Encourage a vegetation specialist to visit sites of proposed timber harvest and provide recommendations for the protection of understory vegetation.

## **WETLANDS**

### Description Bad River Reservation Wetlands

Wisconsin Statute section 23.32(1) defines a wetland as "...an area where water is at, near, or above the land surface long enough to be capable of supporting aquatic or hydrophytic vegetation and which has soils indicative of wet conditions." This definition includes the many different wetland types found on the Reservation, such as floodplain forests, coniferous swamps, lowland hardwood swamps, alder thickets, coniferous bogs, open bogs and fens, sedge meadows, deep and shallow marshes, and shallow open water communities.

Wetland complexes cover more than 25% of the Reservation. Poorly drained clay soils, which cover most of the Reservation, are responsible for the formation of wetlands that are found in depressions where water has accumulated or beaver activity has occurred. Wetlands have also formed beyond the banks of rivers where flooding occurs seasonally. Former river beds and oxbows along the rivers on the Reservation have become wetlands since the rivers changed their courses. Vast expanses of marsh and peat-dominated wetlands occur north of U.S. Highway 2, along the Lake Superior coast.

The largest wetland complex on the Reservation is the Kakagon/Bad River Sloughs, a 12,000-acre estuarine wetland that has formed behind a series of sand spits on the

south shore of Lake Superior. This wetland complex is the Band's most culturally important wetland, as the bulk of the fish caught and wild rice harvested by tribal members occurs here. The Kakagon/Bad River Sloughs are a single freshwater wetland ecosystem that is described in the Federal Registry as "perhaps the finest marsh complex on the upper Great Lakes". Their relatively healthy condition is due to their isolation and the protective stewardship of the Bad River Band.

An assessment of Reservation wetlands conducted in 1995-96 by the BRNRD identified the following functions and values: shoreline and stream bank stabilization, storm water storage, nutrient removal and transformation, sediment and toxicant retention, and high quality habitat for plants, fish, and wildlife. In addition, wetlands have cultural values to the Band. Each of these functions and values is described in greater detail below.

*Shoreline and stream bank stabilization.* The roots of wetland plants bind the soil, holding it in place, while the above ground portions of these plants absorb wave energy. By acting as a buffer between moving water and shoreline, wetlands help control soil erosion and stabilize shorelines and stream banks.

*Storm water storage.* During heavy rains wetlands store massive amounts of water and slow down the flow of surface water, which reduces the danger of flooding during the peak water flow.

*Nutrient removal and transformation; sediment and toxicant retention.* Wetlands play a major role in maintaining the water quality on the Reservation. The plants and soils of wetlands absorb excess inorganic and organic nutrients (e.g., farm fertilizers, pesticides, and septic system runoff), filter sediments, and trap pollutants.

*Plant, fish and wildlife habitat.* The diversity of wetland types on the Reservation provide valuable habitat for many species of plants and animals, some of which are rare, threatened, or endangered. Fish species such as northern pike and walleye require wetlands for spawning. Furbearers such as otter, beaver, mink, and muskrat inhabit the riparian and wetland areas of the Reservation. Many species of birds, such as kingfisher and waterfowl depend on wetlands during a portion of their life cycles.

*Cultural values.* Hunting, fishing, trapping, and gathering activities are important to the cultural and spiritual identity of tribal members. Healthy and functioning wetland ecosystems are necessary to maintain a resource base, which in turn contributes to the preservation of the culture. It is important to protect not only threatened and endangered plants and animals, but also to protect the lifestyles and ways important to the very existence of the individual tribal member.

#### Current Status of Wetland Conservation on the Reservation

The BRNRD drafted a comprehensive Wetlands Conservation Plan consisting of activities related to wetland policy and planning at the watershed level. This conservation plan is under revision and will address cumulative wetland loss within the Reservation.

The BRNRD completed an inventory and assessment of wetlands on the Reservation. Data from the assessment on wetland type, size, function, and value are being incorporated into the Band's GIS.

Two wetland-related ordinances have been drafted: 1) a general Reservation ordinance pertaining to protection of wetlands, and 2) a Kakagon Sloughs ordinance pertaining to increasing development and recreation pressures. Both of these ordinances await approval from the Tribal Council.

#### Issues

- Wetland habitat has been lost or impaired throughout the Reservation due to draining, dredging, filling, excavating, building, polluting, and logging. The cumulative loss of wetlands exerts a greater demand on the functional capacity of remaining wetlands in terms of flood water storage, erosion control, and water quality protection. Damaging or destroying wetlands can threaten public safety and diminish important habitat for plants and animals.

- Potential threats to the ecology of the Kakagon/Bad River Sloughs are numerous. Upstream activity can pollute incoming water or increase the sediment load that is deposited in the sloughs. Motorized boating and jet skis can disrupt wild rice beds directly by mowing through the rice, or indirectly by creating wakes that uproot young plants. Residential areas are a potential source of multiple problems, including faulty septic systems, the introduction of exotic species of plants and animals, and increased

traffic and noise. Exotic species such as purple loosestrife and carp already exist in the sloughs and are being monitored by the BRNRD. Natural fluctuations in the surface level of Lake Superior have an important biological effect on the sloughs (Meeker 1993); thus, the wild rice beds are threatened by efforts to stabilize the lake level through increased control over lake discharges at the Soo Locks in eastern Lake Superior.

- The hydric (wetland) soils found throughout the Reservation are highly suitable for the construction of human-made wetlands. Wetlands incorporated into the design of parking lots and housing developments could act as a catchment and natural filter area for these urban runoff sources. The construction of wetlands on the Reservation is an option that has not been explored fully.

- Purple loosestrife, giant reed grass, and narrow-leaf cattail, all aggressive species, have been observed in some Reservation wetlands. The spread of these invasive species contributes to the degradation of native wetland communities.

### Goal

Conserve existing wetlands and restore degraded wetlands to increase the quality of wetland resources on the Bad River Reservation.

### Objectives

- Encourage wetland conservation through landowner incentive programs. Distribute to all landowners on the Reservation a landowner's assistance guide which explains the range of state, federal, and private incentive programs. Provide information to all landowners within Reservation boundaries on the risk of losing wetland habitats and wetland functions due to logging practices, urban development, and agriculture. Support the Wetlands Reserve Program (WRP) administered by the U.S. Department of Agriculture.

- Encourage local and regional governments and agencies to incorporate wetland protection into their planning processes.

- Prioritize high quality wetlands for protection and acquisition. Acquire alienated land and development rights to protect wetlands permanently.

- Restore and manage disturbed or poor quality wetlands to increase ecological productivity, control floods, and improve water quality.
- Continue the ongoing assessment of rare, threatened, and endangered species found in wetlands.
- Continue to control the spread of invasive exotic species in wetlands.
- Enhance wild rice production in the Kakagon Sloughs by deterring the growth of pickerel weed (e.g., through hand-pulling or mechanical harvesting).
- Visit sites of proposed timber harvest to provide recommendations for the protection of wetlands.
- Adopt an ordinance that protects the Kakagon/Bad River Sloughs from development and recreational pressures.
- Increase tribal control over the protection and use of Reservation wetlands by assuming Federal Clean Water Act Section 404 permitting authority. Section 401 of the Clean Water Act gives tribes the authority to grant, deny, or condition certification of federal permits or licenses that may result in discharge to U.S. waters.
- Develop and adopt a wetland definition for tribal regulatory purposes which recognizes the Reservation's unique wetland types.
- Develop standards and guidelines regarding wetland mitigation and mitigation banking. Wetland mitigation banking is the restoration, creation, enhancement, or preservation of wetlands for the purpose of providing compensation for future wetland degradation or destruction.
- Establish a program to monitor and evaluate wetland restoration and mitigation projects.
- Develop and adopt Reservation wetland water quality standards. These standards should: 1) designate uses for all wetlands, 2) include wetlands in the definition of "Tribal Waters", 3) incorporate criteria relative to aesthetic and biological conditions, and 4) include a wetland anti-degradation policy.

## TIMBER

The history of the timber resources and timber harvest on the Bad River Reservation has an impact on the timber resources of the present day. For a detailed description of timber resources and harvest history on the Reservation, please refer to "A Forestry History of Ten Wisconsin Indian Reservations Under the Great Lakes Agency: Precontact to the Present", by Godfrey (1996). A summary of the forestry history on the Bad River Reservation is included in Appendix D.

### Description of Bad River Reservation Timber Resources

The Bad River Reservation lies on a transition between the boreal forests of the north and the mixed conifer-hardwoods of the Great Lakes region. Because of this transitional location the forests are diverse, and elements of both major forest types exist.

Approximately 77% (96,000 acres) of the Reservation's 125,000 acres is forested. Within these 96,000 acres, the BIA considers nearly 45,700 acres of trust forest lands suitable for commercial timber management (16,412 tribal trust and 29,285 allotted). In addition to these trust lands, 3,931 acres of fee lands are capable of timber production.

At least 29 tree species grow in the forests of the Bad River Reservation, including:

White pine	Paper Birch	Sugar Maple
Red Pine	Yellow Birch	Red Maple
Jack Pine	Trembling Aspen	Silver Maple
Balsam Fir	Big-toothed Aspen	Boxelder
White Spruce	Balsam Poplar	American Elm
Black Spruce	Hawthorn	Rock Elm
Tamarack	White Ash	Red Oak
Hemlock	Green Ash	Burr Oak
White Cedar	Black Ash	Black Willow
Ironwood	Basswood	

Other species occur most likely because people planted them (for example, cottonwood and domestic apple), but are not naturally reproducing species in the forested areas of the Reservation.

The most abundant tree species on the Reservation are aspens (trembling and big-toothed), red maple, paper birch, balsam fir, and white pine (see Figure 7 for types of timber on the Reservation). The present-day forests are a direct result of the widespread timber harvesting and subsequent fires around the turn of the century, and are also influenced by soil type and moisture. The majority of Reservation soils are clay, which are wet most of the year but subject to periods of drought. The Birch Hill and southeast areas of the Reservation are better growing sites, with sand and silt soils. (See the Soils section, beginning on page 33, for complete soil information.)

### Current Timber Management

Many timber managers today use a system called forest habitat typing (Kotar 1988) to aid timber management decisions and to predict the response of vegetation to management activities. Forest habitat typing is based on the identification of different plant associations that indicate the biological potential of a site, i.e., which tree species or mix of tree species may do well on a particular site.

In addition to the Habitat Type System, BIA foresters conduct two forest inventories to determine the condition of the forest and to assist in the planning of management activities. The Continuous Forest Inventory (CFI) revisits a set of permanently established plots every 10-15 years. This inventory, which was first conducted on the Reservation in the 1960s, provides growth and volume information. The BIA completed the fourth re-measurement in 1994. The data are currently being compiled by the BIA's Branch of Forest Resources and Planning (BOFRP) in Lakewood, Colorado. The compiled data should be available in the winter of 1998. (For complete information please refer to the BIA's CFI Field Manual.) The second method of forest inventory is the Operations Inventory, or Stand Exam. This inventory, begun by the BIA in 1985, provides stand-specific data and accurate acreage and spatial (map) information. (For more information please refer to the BIA's Procedural Manual for Operation's Inventory.) Data from this inventory have been incorporated with a geographic information system (GIS) so that forest maps can easily be made and updated.

The BIA retains 10% of all timber sale income on trust lands (both allotted and tribal) and redistributes this money to the Tribal Forestry Program to support forestry activities. Over the six year period from 1991 - 1997, the BIA arranged the harvest of roughly 325 acres per year (approximately 20.3 million board feet; Figure 8), which generated a total income of approximately \$459,000 for the Band and heirs on

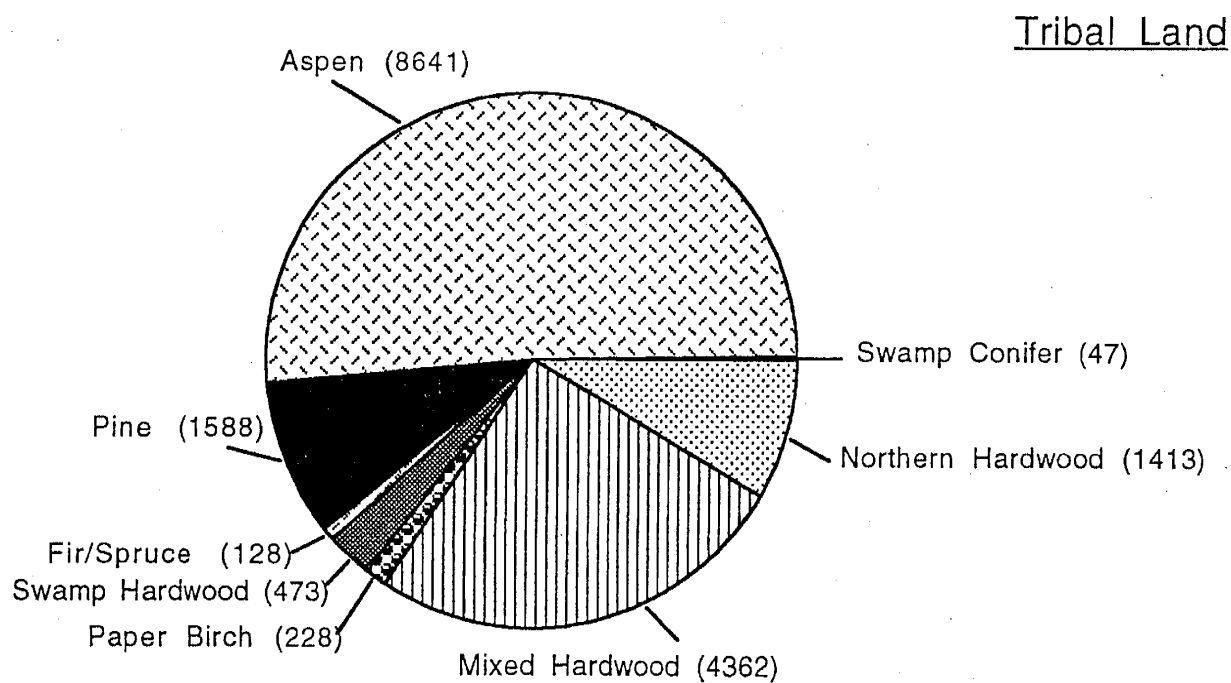
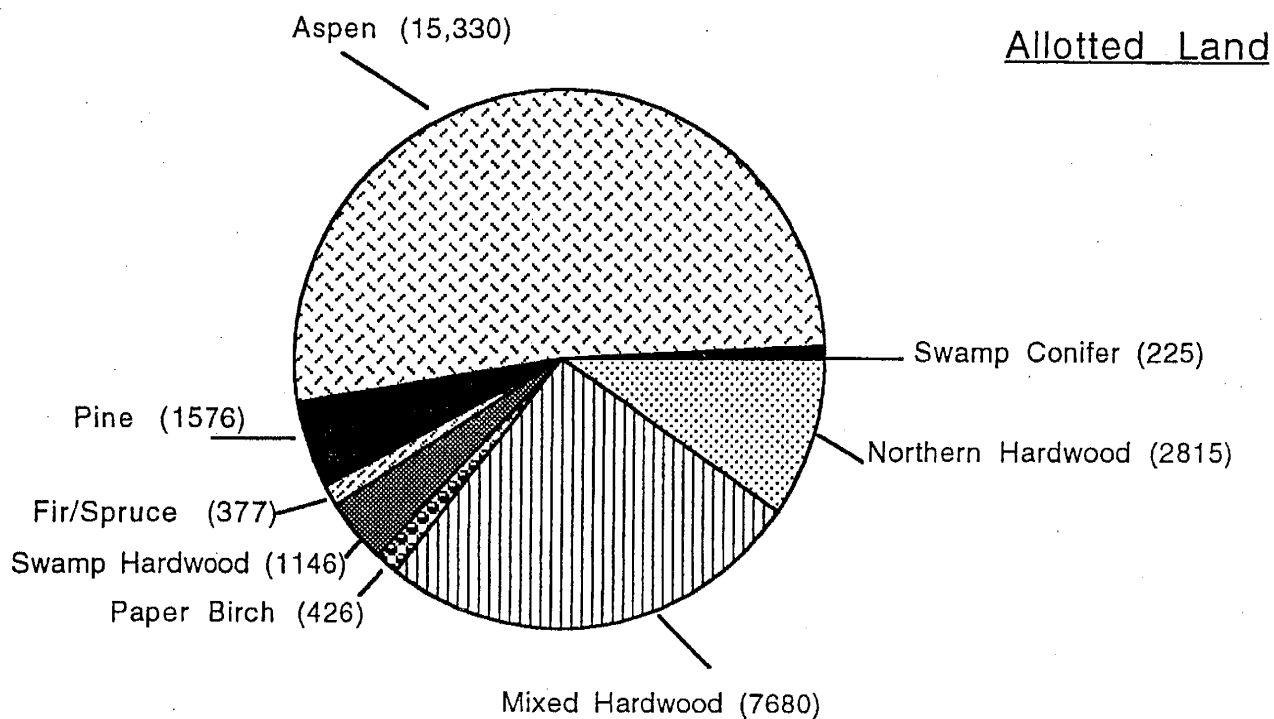


Figure 7. Timber types on tribal and allotted lands of the Bad River Reservation. Acres, in parentheses, are from the 1986-1998 stand exams conducted by the BIA.

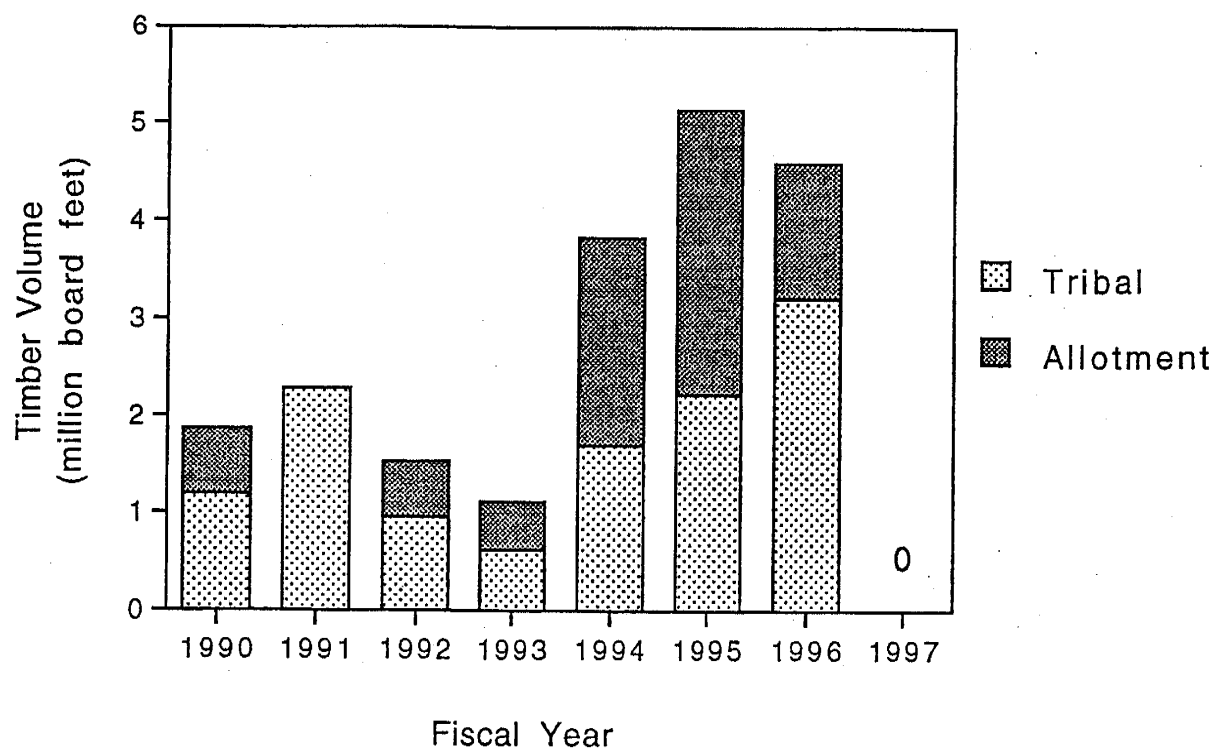


Figure 8. Volume of timber cut through timber sales on trust lands of the Bad River Reservation, 1990-1997.

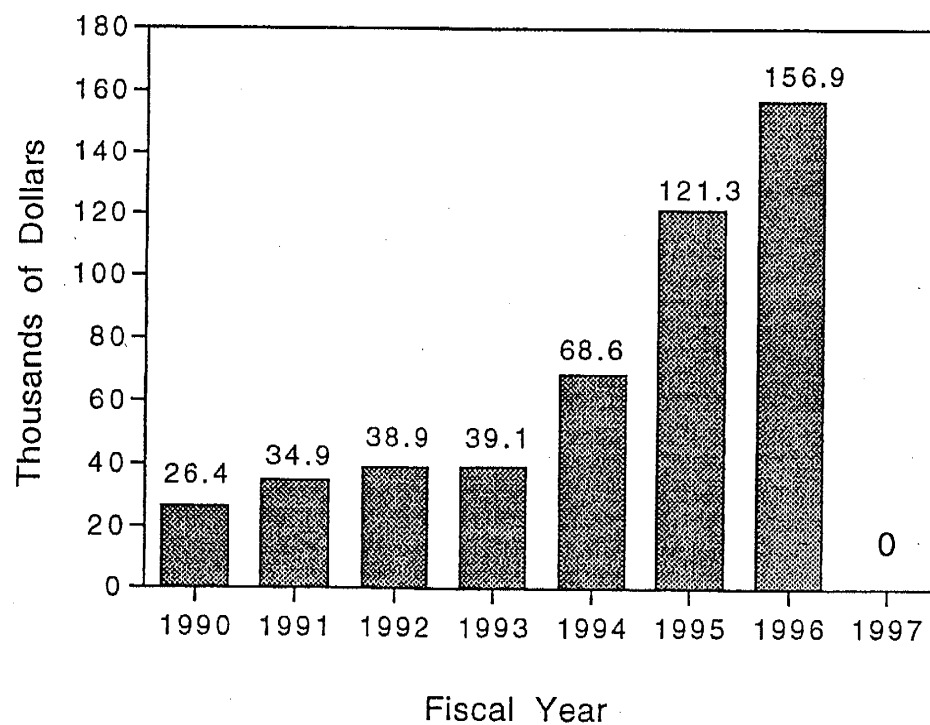


Figure 9. Income generated through timber sales on trust lands of the Bad River Reservation, 1990-1997.

allotments (Figure 9). The Bad River Tribal Forestry Program received 10% of this total, approximately \$46,000, or nearly \$7,700 per year. BIA foresters estimate that this level of harvest is about 30% of what could be managed every year (1,164 acres) if the entire commercial trust forest (45,697 acres) were available for and actively managed for timber products. The Band must consider issues other than financial gain, however, such as the health and sustainability of all the resources on the Reservation.

Independent, non-tribal loggers currently harvest the majority of forest products on Reservation trust lands. Timber is sold on the open market to the highest bidder. The greatest volume harvested in any single year since 1950 was nearly six million board feet in 1980 (Figure 8), which pales in comparison to the volume harvested during the late-1880s to early-1900s (Appendix D, Table D1).

The 5,800 acres of fee land owned by the Band is managed under the Wisconsin Forest Crop Law. To promote a diversity of forest types the Tribal Forestry Technician prescribes harvest of timber on these lands using an intermediate cutting method, where small groups of trees, or individual trees are selectively harvested to allow expansion of the crown and root systems of remaining trees.

Private industry has an active timber harvest program on alienated land within the Reservation. The majority of this industrial land is clearcut for aspen regeneration.

Ashland County has approximately 1500 acres of tax delinquent land on the Reservation. The County is willing to manage these lands in a manner that is consistent with tribal management goals, as long as these goals do not conflict with accepted silvicultural practices and potential sale of the land is not hindered.

### Issues

- Tribal members have expressed concern that sustainability of all resources is of a much higher value than the economic benefits associated with timber harvest. The timber sales program has been a source of conflict among the BIA, the Band, and individual tribal members. Aspen management by clearcutting is the issue that causes the most concern, not only on tribal and allotted lands, but also on private lands within and near the Reservation. On February 18, 1994, the Tribal Council passed a resolution temporarily prohibiting clearcutting on tribal lands and restricting easement

access to alienated and allotted lands until a comprehensive resource management plan was adopted (this IRMP).

- Increased runoff of sediments and nutrients resulting from poor logging practices may degrade water quality of open water bodies. Guidelines for forestry Best Management Practices (BMPs) to protect water quality exist for Wisconsin (WDNR 1995) and have been drafted by the BRNRD. These guidelines may not be strong enough to protect water quality (which is why the Conservation and Watershed Protection Areas, described earlier, are needed). Adherence to existing BMP guidelines has not been monitored on the Reservation.
- Conifers, such as white pine and white cedar, are desirable trees for timber, wildlife habitat, and the prevention of erosion on slopes. These species were abundant on the Reservation prior to the cut-over at the turn of the century. Since then, the conifer component of the forest has decreased and regeneration is poor. The BRNRD planted white pine seedlings on the Reservation in 1996 and 1997 (10,000 and 22,000, respectively). In addition, ten pounds of conifer seeds (white, red, and jack pines) were hand sown in 1996. The rate of success of these plantings has not been closely monitored. Additional management is needed to promote the regeneration of conifer species.
- Old growth forests, which are rare on the Reservation, contribute greatly to biodiversity both on the Reservation and regionally. Past forest management plans do not protect existing old growth areas or promote additional areas.
- Biological diversity plays an important role in ecosystem integrity. Some forestry practices, such as even-aged management (clearcutting and plantations), can decrease native biodiversity. Clearcutting has been the most common method of managing forests on the Reservation.
- Timber management on alienated lands affects resources on tribal lands, yet the Band has limited control over the management practices on these lands.
- As the Band continues to acquire alienated lands on the Reservation the Bad River Forestry Program may require additional personnel and equipment if these lands are to be managed for timber production.

- Many timber managers currently do not recognize the distinction between sustained forest yield and sustainable forestry. The concept of sustained yield has to do with maximizing the amount and quality of forest products (pulp or saw timber) which can be extracted from a forest over time. Sustaining forests, as a concept, however, has to do with maintaining a healthy forest ecosystem, including all the component parts (e.g., trees, forest floor herbs, fungi, insects [like the ants necessary for orchid dispersal], micro-organisms necessary for decomposition, birds that control insect outbreaks, and all other elements of a biologically diverse ecosystem).
- Administrative difficulties arise in the management of timber on allotted lands. Prior to timber harvest or other management on allotted lands, the majority of owners must approve of the proposed management. Allotments often have many owners, sometimes hundreds of owners, making contact difficult. When allottees cannot be reached, and in pending probate decisions, the BIA Superintendent has the authority to approve timber management, including harvest, on their behalf. While the BIA has not exercised this authority often on the Bad River Reservation, the fact that the BIA has this authority is of concern to Bad River members.
- Threatened, endangered, and sensitive plant and animal species are of importance to tribal members. Timber managers are not always aware of where such species occur, leading to management that may not protect these species.
- Areas suitable for non-timber forest products (e.g., birch bark, maple syrup, balsam boughs) have not been identified for protection from timber cutting (with the exception of some sugarbush areas).
- The current fire suppression policy on the Reservation is 100% suppression (i.e., there are no "let burn" areas). Prescribed burning, or allowing an area to burn if a fire starts, is a forest management tool the Band could consider for some areas of the Reservation.
- Tribal members remain largely uninformed of ongoing timber management and harvest practices.

### Goal

Maintain a diversity of forest types within the Bad River Reservation while protecting and improving the water quality of Reservation lakes, rivers, and wetlands. Manage the Reservation's forests in a manner that promotes sustainability not only of the forests, but of all resources. Enact a uniform timber management strategy for all Bad River Reservation lands, regardless of ownership.

### Objectives

- Reserve, protect, and maintain the forest (especially conifers) on slopes and areas adjacent to waterways, according to the Watershed Protection Area principles described on page 15. Such forested buffers will help prevent soil erosion and enhance a slope's ability to filter sediment.
- Promote integration of natural resource management by actively involving the managers of wildlife, water quality, and other tribal resources in timber sale preparations.
- Provide education about timber management activities to the tribal population.
- Establish a cooperative working relationship between the Band and the BIA such that both sides benefit from the relationship.
- Identify and manage additional areas for non-timber resources such as maple syrup and birch bark, especially in areas other than Forest Management Areas.
- If a new road is constructed for the harvest of timber, ensure that the road is closed when the logging operation is complete.
- To reduce soil compaction and rutting due to logging activities, encourage logging activity during frozen ground conditions or during particularly dry years only.
- In order to achieve diversification of Reservation timber resources, increase the conifer component and a variety of hardwood species (such as maple, oak, and ash species) through underplanting, select cutting, and creating an uneven-aged forest. Establish a monitoring program to evaluate the success of such efforts.

- Identify areas within Forest Management Areas that are worthy of protection from logging and suitable for special management considerations. Identify potential restoration sites within Forest Management Areas such as aspen areas with a conifer understory.
- Manage the Reservation forests in a manner that sustains entire forest ecosystems, rather than just providing a sustained product yield.
- Decrease the amount of Reservation land in aspen production.
- Establish monitoring programs to assess the effects of timber harvest on other resources.
- Hire additional tribal forestry personnel and acquire equipment to meet the demands of an expanding tribal forestry program.
- In order to encourage alienated land owners to manage their forested lands in accordance with the principles outlined in the Resource Management Areas descriptions (beginning on page 11), 1) pursue control of alienated lands through easements, 2) secure BIA support of tribal easement control, 3) continue education of and networking with alienated land owners, and 4) continue buying alienated lands.
- Together with the BIA, develop a 10 year timber management plan. This plan should identify specific areas to be harvested, restored, and protected, and should also include specific guidelines for each forest type, such as details on the amount of residual basal area, the number of snags, which tree species to cut and which species to leave, etc.
- Use a landscape analysis across all land ownerships within the Reservation to determine the annual rate of clearcutting, spacing between cuts, harvest deferrals (for promoting older growth), and other similar timber management concerns.

## FISH

The fishery resources of the Bad River Indian Reservation are some of the most highly valued resources to tribal members, for cultural, social, subsistence, and recreational purposes. Based upon responses to the Bad River Integrated Resource Management Plan (IRMP) questionnaire, fishing was the most highly regarded recreational activity among tribal members living on or off the Reservation (Appendix A). In responding to this survey tribal members emphasized that management and enhancement of fishery resources on the Reservation should receive high priority by the Bad River Natural Resources Department (BRNRD).

The significance of the fishery resources of the Bad River Indian Reservation is not limited to the area within Reservation boundaries, but extends to all waters of Lake Superior. Many species of native and non-native anadromous fish (those fish that spend a portion of their life in the lake and enter tributaries to spawn) use waters on the Reservation during some part of their life cycle. The management and regulation of the fishery resources requires cooperation between the Band and other agencies to ensure the preservation of the fishery and the aquatic ecosystem for the continued benefit of future generations.

### Description of Bad River Reservation Fisheries

The Bad River and its tributaries provide more than 391 miles of cold and cool-water fish habitat and drain approximately 659,000 acres. Major cold water tributaries to the Bad River include the Potato, Tyler Forks, Brunsweller, White, and Marengo Rivers. Within Reservation boundaries, the Bad River system consists of approximately 200 miles of stream.

The main stem of the Bad River, downstream of the confluence with the Marengo River, supports a diverse fish community (Table 2). Lake sturgeon and walleye are the most well known fish species inhabiting this portion of the river. Both species are anadromous, although resident populations, particularly of walleye, may exist in the river. Other anadromous species in this portion of the Bad River include white and longnose sucker, and silver and shorthead redhorse. Resident fish species include northern pike, muskellunge, yellow perch, smallmouth bass, rock bass, and a variety of forage and minnow species. In addition, at least four exotic fish species occur in this portion of the Bad River including sea lamprey, rainbow smelt, carp, and ruffe.

Table 2. List of fish species occurring in the main stem of the Bad River, downstream of the confluence with the Marengo River.

Walleye	White Sucker
Yellow Perch	Longnose Sucker
Lake Sturgeon	Greater Redhorse
Smallmouth Bass	Northern Hog Sucker
Pumpkinseed	Silver Redhorse
Bluegill	Shorthead Redhorse
Black Crappie	Brook Trout
Rock Bass	Brown Trout
Northern Pike	Rainbow Trout
Muskellunge	Coho Salmon
Brown Bullhead	Chinook Salmon
Black Bullhead	Burbot
Tadpole Madtom	Logperch
Stonecat	Johnny Darter
Common Shiner	Creek Chub
Golden Shiner	Hornyhead Chub
Sand Shiner	Slimy Sculpin
Mimic Shiner	Longnose Dace
Blacknose Shiner	Finescale Dace
Spottail Shiner	Blacknose Dace
Brook Stickleback	Troutperch
Sea Lamprey	Central Mudminnow
Ruffe	Rainbow Smelt
Common Carp	Stoneroller

The upper Bad River, upstream of the confluence with Marengo River, along with the major tributaries to the Bad River, contain resident brook and brown trout, and provide spawning and nursery areas for anadromous salmonids (species in the trout and salmon family), including coho, chinook and pink salmon, and rainbow and brown trout. Of these salmonid species, only the brook trout is native to these rivers. Forage fish and minnow species are also present in these rivers, but comprehensive species inventories have not been conducted. Sea lamprey, rainbow smelt, and perhaps other non-native fish species occur in some of these rivers.

The White River also provides spawning habitat for walleye and a variety of sucker species (longnose and white suckers, and shorthead and silver redhorse) that migrate into this system from Lake Superior. Lake sturgeon have been documented downstream of the White River hydroelectric dam and it is likely that spawning occurs in this river. While this hydroelectric dam is a barrier to fish migration, prior to dam construction a natural falls at this site prevented upstream fish migration.

The Kakagon River and Sloughs, together with the tributaries Bear Trap Creek and Wood Creek, form another important system for fishery resources on the Reservation. Although this system drains a relatively small watershed of approximately 30,500 acres, it provides critical spawning and nursery areas for an anadromous walleye population and habitat for other cool water species, including northern pike, yellow perch, smallmouth bass, rock bass, bluegill, pumpkinseed, black crappie, black bullhead, white and longnose suckers, and silver and shorthead redhorse. In addition, at least four non-native fish species inhabit the Kakagon River and Sloughs, including carp, ruffe, white perch, and rainbow smelt.

The Bad River Slough and Honest John Lake are important spawning and nursery areas for yellow perch and northern pike. These areas also provide habitat for a variety of forage fishes, as well as the exotic species, carp and ruffe.

Fish undoubtedly occur in the inland lakes and oxbows of the Bad River flood plain, but surveys have not been conducted to determine the species of fish or their abundance levels.

Several small creeks on the Reservation, such as Morrison Creek (2.0 miles long) and Graveyard Creek (2.9 miles long), empty directly into Lake Superior. These creeks generally have small, high gradient watersheds. Fishery resources in these tributaries to Lake Superior have either not been inventoried or consist primarily of minnow and forage fishes, with the exception of Graveyard Creek, which contains a resident brook trout population of unknown size.

#### Bad River Tribal Fish Hatchery

In 1975, the Bad River Tribal Fish Hatchery (BRTFH) was constructed on the Kakagon River. In the early years of hatchery operations, northern pike and walleye eggs were

raised, and the fry and fingerlings were released into the Kakagon and Bad River Sloughs.

In 1988, the Great Lakes Indian Fish and Wildlife Commission (GLIFWC) biologists collected eggs from a single female lake sturgeon in the Bad River. Eggs were fertilized and reared at the BRTFH and at a state hatchery in Minnesota. A total of 2500 fingerlings were stocked into the Bad River and about 290 fingerlings were stocked into the St. Louis River, on the Wisconsin/Minnesota border. The St. Louis River stocking was part of a lake sturgeon restoration effort by the Wisconsin and Minnesota Departments of Natural Resources that continues today.

In 1988 and 1989, walleye fry reared at the U.S. Fish and Wildlife Service (USFWS), Genoa National Fish Hatchery (GNFH) were stocked into the Kakagon and Bad Rivers. The stocking of walleye from GNFH was discontinued due to genetic concerns related to mixing of Mississippi River drainage stocks with Lake Superior drainage stocks. Also in 1989, brook trout from GNFH were stocked into the Potato River. Stocking of brook trout was discontinued for genetic reasons as well.

The BRTFH provided walleye fry to the Wisconsin DNR for rearing at a state hatchery in 1993 and 1995. The DNR stocked all fingerlings in Chequamegon Bay in 1993. In 1995, the fingerlings were stocked into Chequamegon Bay and the Kakagon and Bad Rivers. In 1998, the BRTFH supplied six quarts of walleye eggs to WDNR, who then stocked 22,000 fingerlings in Chequamegon Bay and 6,000 fingerlings in the Bad River.

The primary purpose of the hatchery today is to collect gametes from adult Kakagon River walleye, raise the fertilized eggs to the fry or fingerling stage, and stock the fry and fingerlings into the Kakagon and Bad Rivers to maintain and enhance the fishery for tribal members. Walleye production has reached 10 million fry during peak years (Appendix E1). Some fry have been raised to the fingerling stage in rearing ponds on the Reservation.

#### Walleye Fishery

The Kakagon River adult walleye population has been studied extensively by the BRNRD and through cooperative work with the USFWS, Ashland Fishery Resources

Office. Mark and recapture estimates of walleye abundance from 1988 to 1990 indicated that the annual spawning run was about 6,000 adult walleye. In 1994, the population of adult walleye (> 16 inches) had tripled, to approximately 18,011 (Slade 1994). The BRNRD and USFWS estimated the 1998 adult walleye population to be approximately 27,000. Several uncertainties exist with the 1998 work which could have resulted in an over-estimate of the walleye population of unknown proportions.

Based on the USFWS and BRNRD 1994 population estimates, an annual safe harvest level of 1,310 walleye was established. This safe harvest level is an estimate of the total annual harvest the population can withstand without negative impacts. Allocation to tribal subsistence fishers was set by the Bad River Band at 1,210 annually from 1994 - 1997, with the remaining 100 walleyes reserved for the hook and line fishery. In 1998, the Band raised the safe harvest level to 1,750: 1,650 for tribal subsistence fishers and 100 for hook and line fishing.

The tribal subsistence season is regulated by the Band and is directly linked to Tribal Hatchery operations. Each spring, the BRNRD collects gametes (eggs and sperm) from adult fish for rearing at the BRTFH. Walleye harvest is prohibited during the time hatchery personnel collect gametes. Upon completion of gamete collection, a tribal subsistence gill and dip net fishery exists until the harvest quota is reached, typically about 7 to 10 days. Harvest of walleye in the Kakagon Slough is monitored by BRNRD staff at the hatchery bridge and at the boat landing. Once the quota is reached, the gill and dip net fishery is closed.

#### Current Status of Cooperative Management Initiatives

The Strategic Great Lakes Fisheries Management Plan (SGLFMP), signed by all agencies with management responsibilities for Great Lakes fisheries, commits signatory agencies to plan for the restoration and maintenance of desirable fish communities using a strategy of consensus. The Bad River Band is represented by GLIFWC on the Lake Superior Committee (LSC), a committee concerned with Lake Superior issues (each of the Great Lakes has its own committee). Resource goals of SGLFMP and those developed under its auspices are shared and supported by the Bad River Band. The Common Goal is "to provide fish communities, based on foundations of stable self-sustaining stocks, supplemented by judicious plantings of hatchery-reared fish, and provide from these communities an optimum contribution of fish, fishing opportunities and associated benefits to meet needs identified by society

for wholesome food, recreation, employment and income, and a healthy human environment."

The Bad River Band is also represented by GLIFWC on the Lake Superior Technical Committee (LSTC), a committee within LSC which is responsible for the recommendation and coordination of management and research activities in Lake Superior waters and its tributaries. The BRNRD has participated in the development of LSTC status reports and restoration plans for lake sturgeon, walleye, and brook trout, and is cooperating with the LSC on a Lake Trout Restoration Plan, implemented in 1996.

### Control of Exotic Species

#### Sea Lamprey

Sea lamprey are native to the North Atlantic Ocean. They normally live in saltwater and migrate to freshwater streams to spawn. Lamprey invaded the Great Lakes in the 1800s and were first recorded in Lake Superior in 1938. In the Great Lakes they have adapted to, and live their entire life in freshwater. Adult sea lamprey are parasitic on other fish, especially trout, salmon, and whitefish. The mouth of a lamprey consists of a tooth-lined sucking disc, which enables the lamprey to attach and remain attached to its host. The lamprey rasps a hole in the side of its host with its rough tongue and secretes an anticoagulant to keep the blood from clotting and the wound open. A lamprey may remain attached to its host for hours, days, or weeks, while it feeds on blood and other body tissues. During its lifetime, a lamprey kills approximately 40 pounds of fish.

The Bad River produces more larval sea lamprey than any other U.S. tributary of Lake Superior, contributing 20-30% of the parasitic sea lamprey population (Schleen et al. 1996). It is important that the Band, in cooperation with the USFWS, develop an integrated sea lamprey management plan which will maintain and enhance the fishery of the Bad River system.

The Bad River Band is committed to optimum control of sea lamprey populations using an integrated approach that works toward a goal of completely eliminating TFM (a lampricide known technically as 3-trifluoromethyl-4-nitrophenol) use in the Bad River by

2005. Tribal leaders and BRNRD have expressed strong interest in alternative controls for sea lamprey, such as the release of sterile males in the Bad River, and placement of a barrier to block upstream migration of spawning-phase sea lampreys. Studies by the BRNRD and USFWS are in progress to determine the effect of a sea lamprey barrier on the movements of lake sturgeon and walleye in the Bad River, as well as the effects on the entire fish community inhabiting the Bad River.

The Great Lakes Fishery Commission (GLFC) policy for sea lamprey control in the Great Lakes encourages development and use of alternative control techniques to reduce reliance on lampricides to 50% of the 1990 level by the year 2000. Currently GLFC controls sea lamprey populations through an integrated management approach involving TFM, release of sterilized male lampreys, barriers, and trapping of spawning-phase lampreys. Sea lamprey populations in the Great Lakes have been reduced by approximately 90% of pre-treatment levels, and the fish populations are rebounding. Despite this success, however, continuous control of sea lamprey is required because enough lamprey remain after treatments to cause high mortality of fish in Lake Superior. While lampricide has been proven an effective control technique, work toward less dependence on chemical control and improved integrated management of sea lamprey continues in the effort to protect the Great Lakes Fishery.

For a detailed summary of lamprey surveys, lamprey control history on the Reservation, assessment of lampricide on organisms other than lamprey, reduction of lampricide use, and alternatives to lampricide use, please refer to Appendix E2.

### Carp

The carp, native to Asia, was first introduced into Wisconsin in the early 1880s (Becker 1983). Since its introduction, this exotic species has become abundant in large, shallow lakes and streams in southern and central Wisconsin. In recent years carp have become common in some northern Wisconsin waters as well, such as the Kakagon River and Sloughs.

Problems associated with carp were recognized as early as 1891-1892, when the Wisconsin superintendent of fisheries called them "a great nuisance because they destroy wild rice beds by their ground hog proclivities" (Becker 1983). As the carp population increased in the Kakagon Sloughs, the BRNRD has attempted to reduce the impact of carp on wild rice beds. The BRNRD places large mesh gill nets near the

most vulnerable rice beds to prevent the carp from uprooting the young rice. The carp caught in the gill nets are removed and destroyed.

### Ruffe

The ruffe is a Eurasian species in the perch family that poses a potential threat to native fish communities through competition for food and space, and through predation on eggs. This species was first encountered in the St. Louis River estuary on the Minnesota/Wisconsin border in 1987 (Pratt et al. 1992). The introduction of ruffe was probably the result of ballast water discharged by an ocean-going ship. Since they were first detected in 1987 ruffe have rapidly increased in abundance, so that by 1991 they were the most abundant fish as sampled by bottom trawl in the St. Louis River estuary (Edwards 1995).

Ruffe have no commercial or sport value, and they are known to proliferate rapidly in preferred habitat (turbid water, deep natural channels, and slow current), such as that found in much of the lower Bad River and parts of the Kakagon Slough complex.

The USFWS began ruffe surveillance in the Bad River in 1992, and in the Kakagon Slough in 1994, as part of an effort to document the range expansion of ruffe outside the St. Louis River estuary. No ruffe were captured the first year of surveillance in either location. Ruffe were captured in low numbers in subsequent years until 1997, when 443 were captured in the Bad River and 82 in the Kakagon Slough (Appendix E3).

USFWS surveillance catch data indicate that ruffe distribution varies seasonally in Bad and Kakagon River systems. Ruffe catch is small or nonexistent in spring and early summer when water temperature is low. The majority of specimens have been collected in August and September using bottom trawls. Trawl catches decrease again in late October and into early November.

### Issues

- Little is known about the size and structure of lake sturgeon and walleye stocks in the Bad River. Assessment surveys to describe the biological characteristics, abundance, habitat use, and movement of lake sturgeon and walleye in the Bad River have been conducted periodically since 1988 by the BRNRD, GLIFWC, and through cooperative work with the USFWS, and WDNR. While some valuable information has been gained,

high flow, fast current, and fluctuating water levels have limited the success of these assessment surveys.

- The Bad River lake sturgeon stock is one of only two documented spawning populations remaining in U.S. waters of Lake Superior. Lake sturgeon are known to spawn at the lower falls, and are believed to spawn at the upper falls. The larval sturgeon drift downstream and inhabit the lower river where they forage before entering Lake Superior. Identification and protection of critical spawning and nursery habitat is vital to the existence of this population. Although lake sturgeon are generally considered to have a healthy population throughout the state of Wisconsin, they are currently listed as threatened or endangered in 19 of the 20 states of their original home range and are a species of concern at the federal level.

- State of Wisconsin fishing regulations in Lake Superior currently allow state licensed anglers with a permit to harvest one lake sturgeon greater than 50 inches annually. Between 1983 and 1993, the total average annual sport angler harvest from Lake Superior was four. The number of lake sturgeon harvested annually by tribal members for subsistence is unknown. Because lake sturgeon are anadromous, fish from the Bad River population are harvested both on and off the Bad River Reservation. Lake sturgeon life history characteristics, such as late age of maturity (10-20 years of age) and infrequent spawning (females spawn only once every 2-7 years), combined with unknown harvest levels make this population vulnerable to over-exploitation.

- Walleye, which are the most sought after species in the Bad and Kakagon Rivers, are presumed to spawn at the lower and upper falls of the Bad River. Since 1985, GLIFWC has conducted creel surveys at the lower falls during the spear fishing season. The size of this spawning population remains unknown, however, because creel survey data do not provide information on population size. Tribal subsistence and sport harvest of walleye occurs in Bad River Reservation waters through spearing, gill netting, and angling. While tribal subsistence fishing is closely monitored in the Kakagon River system, the number of walleye taken by anglers is not known. In the Bad River system, no monitoring of the walleye fishery occurs. Because walleye are anadromous fish, they are harvested both on and off Reservation and stocks are vulnerable to over-exploitation.

- Tests of walleye from the Kakagon River and Slough in 1993 showed mercury levels above the consumption advisory limit. As of 1998 no fish in the Bad River have been tested for mercury or other persistent contaminants.
- The Bad River system, which is a major spawning and nursery area for the non-native sea lamprey, is estimated to be the largest producer of this species in Lake Superior. The control of lamprey is a major concern of the BRNRD.
- Extensive habitat surveys for species other than lamprey have not been conducted in the Bad River system.
- Logging, agriculture, road construction, and residential and industrial development have occurred throughout the Bad River watershed, both on and off the Bad River Reservation. Such activities have negative effects on fishery and aquatic resources due to sedimentation. In the main stem of the Bad River the heavy load of sediments (primarily sand) has resulted in large expanses of homogeneous habitat, likely reducing production of fish.
- The Bad River Tribal Fish Hatchery has served a critical role in the restoration of the walleye fishery in the Kakagon River and contributed to the development of the Chequamegon Bay walleye population. However, the extent of the contribution of stocked walleye to the Kakagon River and Bad River populations has not been examined.
- In spite of protection, threats to Bad River Reservation fishery resources continue, including sedimentation, boat traffic, the invasion and spread of exotic species, increasing numbers of sport fishers, lack of harvest information, and point and non-point source pollution.
- Surveys and descriptions of fishery resources in other tributaries to Lake Superior and inland lakes on the Bad River Reservation have not been conducted.

#### Goal

- Maintain, restore, and enhance native fish communities in waters of the Bad River Reservation and in waters of Lake Superior for the continued benefit of Bad River members and for the maintenance and restoration of stable aquatic ecosystems.

### Objectives

- Identify and protect vital spawning and nursery habitat for lake sturgeon and walleye.
- Initiate efforts to obtain biological and population data on walleye and lake sturgeon from non-tribal and tribal fishers. Continue to monitor biological and catch data from the subsistence walleye fishery.
- Use scientifically collected data to establish management practices which perpetuate self-sustaining populations of lake sturgeon and walleye. Update Kakagon River total allowable catch quota every 1-4 years.
- Continue to provide healthy sturgeon and walleye eggs, fry, and fingerlings, as needed for fulfillment of fishery management goals. Use gametes from fish captured on the Bad River Reservation for these efforts whenever possible to preserve the genetic identity of this population.
- Collect data on the importance of hatchery stocks to recruitment.
- Evaluate the potential for degradation of genetic integrity of the walleye stock due to prolonged hatchery rearing.
- Achieve jurisdiction over, and regulation of, non-tribal fishing activities occurring within Bad River Reservation boundaries.
- Conduct inventories of fish communities in tributary rivers and inland lakes on the Bad River Reservation.
- Determine contaminant levels in fish in Bad River Reservation waters.
- Establish erosion control, point and non-point source pollution prevention, and riparian habitat protection measures to provide long-term sustainability of fishery resources on the Bad River Reservation.
- Continue carp control activities in Bad River Reservation waters.

- Continue to reduce the sea lamprey population through the exploration of alternative methods of control, such as construction of barriers to migration, trapping and removal, and release of sterilized males and females, while simultaneously eliminating the use of TFM on the Bad River Reservation by the year 2005.
- Provide educational information (presentations, handouts, identification cards, etc.) to tribal fishers who fish or smelt in the Kakagon and Bad River systems, designed to provide positive identification of ruffe and outline procedures for handling and disposal of this exotic species.
- Continue regular surveillance of ruffe in both the Kakagon and Bad River systems to document changes in abundance and distribution of ruffe and native fishes. Examine alternative techniques for enhanced ruffe control, (for example, research on sex pheromones as attractants for female ruffe has shown potential for capture and control in laboratory experiments).
- Make control of ruffe in the Kakagon River a priority, since the population in this river is smaller, more limited in distribution, and likely to be more vulnerable to reduction efforts than in the Bad River.

## **WILDLIFE**

### Description Bad River Reservation Wildlife

Most of the Bad River Reservation could be characterized as excellent wildlife habitat. Human influence has been relatively light over most of the Reservation, except with regard to timber harvesting, which has been the overriding influence on the richness and abundance of plants and animals.

Wildlife species on the Reservation are typical of northern temperate forests. Game species include white-tailed deer, ruffed grouse, black bear, snowshoe hare, and gray squirrel. Furbearing species include bobcat, beaver, coyote, raccoon, red fox, mink, weasel, muskrat, otter, and fisher.

Breeding waterfowl, especially mallard, blue-winged teal, black duck, and wood duck, are found on the Kakagon Sloughs, Bad River Slough, and Honest John's Lake, as well

as on the river oxbows and beaver ponds scattered throughout the Reservation. Waterfowl also use the Sloughs as staging areas during migration periods.

In addition to game species, the Reservation has many vertebrates and invertebrates that are critical to the long-term maintenance of the Reservation's ecological integrity. Species that are rare (e.g., timber wolf and bald eagle) or are culturally important (e.g., black bears and turtles) are intimately connected to peoples on the Reservation and require special management consideration and protection.

The most significant impact on all wildlife species will continue to be human manipulation of habitat and changes in the global environment. Timber management, human population growth, and atmospheric change will affect wildlife species composition and population levels. Northern Wisconsin has experienced the warmest decade in a century of weather recording, and atmospheric change models generated for this bioregion all suggest a warming trend that is caused through anthropogenic (human-made) activity. Movement patterns and forage bases for wildlife may be altered in the future, and natural resource managers must be aware of such large scale environmental changes within specific management units to preserve the integrity of natural systems.

The management philosophy of the BRNRD is to restore some late successional habitats (e.g., old growth forests) in order to protect and encourage animal species indicative of pre-European settlement times in this bioregion. The pre-settlement condition serves as an ideal model for the restoration of an ecosystem, because the rich biological diversity of that time provided a sustainable existence for the original peoples. The Resource Management Areas (detailed on pages 12 -20) include areas where young forests will exist (Forest Management Areas) as well as areas that can mature into old growth forests (Conservation and Watershed Protection Areas), providing a diversity of habitats for wildlife.

### Issues

- Wildlife habitat, and thus wildlife populations, are responding to habitat management practices which are currently largely beyond the influence of wildlife managers (e.g., logging methods, construction of new housing and commercial developments, global environmental change).

- Habitat manipulations are conducted with a limited amount of consideration for the maintenance of biodiversity and watershed protection.
- The fragmented ownership of the Reservation limits the BRNRD's ability to influence best management practices (see the section on Timber, beginning on page 65, for more information on best management practices) on all lands within the Reservation.
- Wildlife management programs are inadequately funded to meet BRNRD goals.
- The population status of many wildlife populations is unknown. Biological inventory information on non-game species is inadequate. Harvest levels of many game species is unknown, making management difficult.
- Uniform policies for addressing the re-introduction of species, such as trumpeter swan and elk, are lacking. For example, the reintroduction of elk at a site approximately 20 miles from the Reservation's southern boundary could jeopardize a pioneering breeding moose population on the Reservation.

#### Goal

Maintain a diverse mix of plant and animal communities on the Bad River Reservation through ecosystem management strategies, habitat protection, active land management, and regulation. Maintain a level of game species that is sustainable, yet does not jeopardize other resources (e.g., overpopulation of deer jeopardizes regeneration of white cedar and hemlock).

#### Objectives

- Implement or continue wildlife population surveys of important indicator species related to ecosystem management strategies.
- Protect wildlife game species populations while meeting tribal members' harvesting needs. Initiate efforts to monitor harvest of game species and develop and enforce adequate harvest regulations.
- Continue to develop Reservation-wide geographic information system (GIS) data layers to identify and delineate wildlife occurrences and the habitats used as a tool to assist in making informed management decisions.

- Obtain the funding necessary to maintain wildlife research, management, and protection programs.
- Encourage public education and participation to accomplish the goals and objectives of the wildlife program.
- Visit sites of proposed timber harvest and provide recommendations to ensure the protection of wildlife at these sites.

### **THREATENED, ENDANGERED, RARE, AND CULTURALLY SENSITIVE SPECIES**

#### **Description of Threatened, Endangered, Rare, and Culturally Sensitive Species of the Bad River Reservation**

Threatened and endangered (T&E) species are species of plants and animals whose populations are imperiled. The exact definitions of T&E species vary depending upon the geographic perspective being used. For example, the U.S. federal government's definition of an endangered species is "any species or subspecies which is in danger of extinction throughout all or a significant portion of its range." The State of Wisconsin, in comparison, defines endangered species as "any species whose continued existence as a viable component of this state's wild animals or plants is determined by the DNR to be in jeopardy on the basis of scientific evidence," and threatened species as "any species which appears likely, within the foreseeable future, on the basis of scientific evidence to become endangered."

A growing demand exists among the public, and tribal members in particular (based on the IRMP questionnaire), to preserve and protect all the native species found in the region, especially those species which are endangered, threatened, or of cultural significance. The preservation of threatened, endangered and other sensitive species is related to the protection of biological diversity and the healthy maintenance of the Reservation ecosystem. If habitats are to be protected or species are to be managed for their respective minimum area and genetic requirements, then anthropogenic (human-made) pressures must be reduced and long-term survivorship will be enhanced for all species.

No definition of threatened or endangered species currently exists for the Bad River Reservation, thus there is no official list of T&E species for the Reservation, and no tribal policy regarding T&E species. As a tribal list is developed, federally listed T&E species known or suspected to be found on the Reservation should be included, since these species are in peril in all or significant parts of their range. The appropriateness of including state-listed species on the Reservation list may depend upon several factors, including the likelihood of finding the species on the Reservation, the health of populations existing outside the state, and the significance of the species to the Band. A tribal T&E list could also include species not listed by either the state or federal government, if there is a desire to protect certain species which are rare or culturally significant on the Reservation, even if common elsewhere.

In 1995, the BRNRD initiated a database listing Wisconsin and federal threatened, endangered, rare, and culturally sensitive species found on the Reservation. The T&E species list, the Natural Heritage working list for the State of Wisconsin, and the criteria for state listing are available through the BRNRD. Several of the species on the state list have been observed on the Reservation, including bald eagle, peregrine falcon, osprey, timber wolf, pine marten, common tern, Forster's tern, piping plover, wood turtle, and showy and ram's-head lady's slippers. Although some of the species on the state list are not breeding residents, the Reservation provides important foraging and staging habitats (habitats in which large numbers of a species may congregate prior to migration) critical for their survival. In addition, it is unknown how many species may be permanent residents on the Reservation, since adequate species inventories have not been conducted.

#### Issues

- A sensitive species list currently does not exist for the Reservation.
- Information is lacking for many sensitive species which occur on the Reservation. Without data on the populations of sensitive species, a coordinated management effort to protect and enhance these species is not possible.
- More funding is required in order to support inventory and research for the protection of the Reservation's sensitive species.

- The impact of the Reservation's timber program on sensitive species has not been evaluated. It may be necessary to alter or restrict current management practices in some areas to protect these species.
- Restoration or reintroduction of T&E species may have an impact on the existing resource base, and may require the development of protection policies.

#### Goal

Identify, protect, and promote existing populations of sensitive species on the Bad River Reservation.

#### Objectives

- Establish a Bad River Reservation endangered species list.
- Obtain funding necessary to allow initiation of a sensitive species program.
- Conduct surveys for sensitive species.
- Determine measures necessary to protect identified populations of sensitive species and their associated habitats.
- Coordinate timber management and harvest, and other resource management activities, to maintain or expand sensitive species on the Reservation.
- Visit sites of proposed timber harvest and make recommendations for the protection of T&E species.

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**APPENDIX A. BAD RIVER IRMP QUESTIONNAIRE AND**  
**SUMMARY OF RESPONSES**

## Bad River Integrated Resource Management Plan Questionnaire

The following are the results of the Bad River Integrated Resources Management Plan (IRMP) questionnaire. Although all Bad River tribal members were mailed the questionnaire, many questionnaires were returned by the post office due to outdated addresses. The total number of respondents was 707. Of these, 83 were from respondents living on the reservation.

The results provided below indicate the percentage of respondents choosing each answer. The "Total %" column show answers from all 707 respondents. The "Rez %" column show the responses from the 83 on-reservation respondents. In most cases, blank responses have been indicated by "n/a". Those questions requiring a text answer have been compiled separately as an addendum to this report (on-reservation responses were not separated for these). Note that percentages do not always add to 100% due to inappropriate responses.

1.	What is your residential status?	Total %	Rez %
	Live on or near the Bad River Reservation	24.3	98.8
	Live within the state of Wisconsin	34.8	-
	Live outside the state of Wisconsin	39.6	1.2

2.	What is your sex and age?	Total %	Rez %	Ave Age (Total)	Ave Age (Rez)
	Female	48.1	41.0	42	44
	Male	49.5	55.4	41	42

3.	Please indicate the level of education received, year completed.	Total %	Rez %
	K-8	3.1	3.6
	9-12	40.4	43.4
	13-14	23.7	24.1
	15-16	10.5	12.0
	16+	11.6	6.0
	Other	1.8	3.6
	n/a	8.8	7.2

4.	What is your annual income?	Total %	Rez %
	Less than 5000	13.2	15.7
	5000 to 10000	14.9	20.5
	10000 to 20000	13.7	19.3
	15000 to 20000	10.9	12.0
	20000 to 30000	17.8	15.7
	30000 to 40000	13.0	-
	40000 to 50000	5.9	6.0
	50000 to 60000	2.5	1.2
	60000 over	2.1	2.4
	n/a	5.8	7.2

5.	When was the last time you travelled through the Reservation and enjoyed the natural resources available?	
----	---	--

6.	* If you never visited the Reservation, skip the next question. How well do you think the Reservation's Natural Resources are being managed?	
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## NATURAL RESOURCE GOALS

Please grade the following Natural Resource goals for the Bad River reservation.

Grade	Level of Importance				
A	Extremely important goal.				
B	Important goal.				
C	Somewhat important goal.				
D	Not an important goal.				
E	Should be dropped as a goal.				

7.	Encourage economic development on the reservation.	A	B	C	D	E	n/a
	Total %	44.6	29.4	12.2	3.7	1.4	8.8
	Rez %	49.4	27.7	14.5	2.4	-	6.0

8.	Preserve scenery and natural beauty.	A	B	C	D	E	n/a
	Total %	65.1	23.8	2.3	0.1	-	8.8
	Rez %	59.0	32.5	2.4	-	-	6.0

9.	Encourage tourism on the reservation.	A	B	C	D	E	n/a
	Total %	21.1	25.3	24.5	12.6	4.8	11.7
	Rez %	25.3	27.7	18.1	18.1	1.2	9.6

10. Inform members about natural resources issues more often.
- |         |      |      |      |     |     |
|---------|------|------|------|-----|-----|
| A       | B    | C    | D    | E   | n/a |
| Total % | 41.3 | 36.6 | 10.6 | 2.1 | 0.6 |
| Rez %   | 41.0 | 45.8 | 9.6  | -   | 3.6 |
11. Increase outdoor recreation opportunities for tribal members.
- |         |      |      |      |     |     |
|---------|------|------|------|-----|-----|
| A       | B    | C    | D    | E   | n/a |
| Total % | 31.0 | 33.8 | 18.0 | 5.2 | 1.4 |
| Rez %   | 39.8 | 32.5 | 10.8 | 7.2 | 4.8 |
12. Preserve the environmental quality of the Reservation
- |         |      |      |     |     |     |
|---------|------|------|-----|-----|-----|
| A       | B    | C    | D   | E   | n/a |
| Total % | 68.9 | 17.4 | 3.4 | 0.3 | 0.3 |
| Rez %   | 69.9 | 24.1 | 2.4 | -   | 3.6 |
13. Other \_\_\_\_\_

#### FORESTRY

14. How many times have you made maple syrup or sugar within the past five years?

0	1	2	3	4	5	n/a
Total %	88.0	4.5	3.0	0.7	0.4	0.6
Rez %	74.7	10.8	7.2	2.4	1.2	2.4

Forest and timber management on the reservation is one of the primary responsibilities in the Tribal natural resource department. The Tribe and the BIA work to manage approximately 46,240 acres of Tribal and allotted forest lands. While environmental concerns have been raised about certain forestry practices, approximately \$40,000 a year is generated for Tribal land purchases through timber harvesting, which makes restrictions in harvesting levels a difficult task.

Please grade the following forestry goals.

Grade	Level of Importance
A	Extremely important goal.
B	Important goal.
C	Not an important goal.
D	This is not a desirable goal and should be dropped.

15. Increase levels of clear cutting to maintain aspen
- |         |     |      |      |      |
|---------|-----|------|------|------|
| A       | B   | C    | D    | n/a  |
| Total % | 7.5 | 26.4 | 20.9 | 19.8 |
| Rez %   | 1.2 | 21.7 | 25.3 | 28.9 |

16. Maintain existing harvest levels
- |         |      |      |      |      |
|---------|------|------|------|------|
| A       | B    | C    | D    | n/a  |
| Total % | 15.6 | 32.1 | 19.8 | 5.9  |
| Rez %   | 12.0 | 21.7 | 27.7 | 13.3 |
17. Lower harvest levels
- |         |      |      |      |     |
|---------|------|------|------|-----|
| A       | B    | C    | D    | n/a |
| Total % | 12.4 | 27.3 | 23.9 | 8.1 |
| Rez %   | 20.5 | 33.7 | 14.5 | 6.0 |
18. Develop greater re-seeding efforts/ tree nursery
- |         |      |      |     |     |
|---------|------|------|-----|-----|
| A       | B    | C    | D   | n/a |
| Total % | 55.6 | 25.2 | 1.4 | 0.4 |
| Rez %   | 62.7 | 20.5 | 2.4 | 1.2 |
19. Emphasize old-growth management
- |         |      |      |     |     |
|---------|------|------|-----|-----|
| A       | B    | C    | D   | n/a |
| Total % | 33.1 | 32.7 | 9.2 | 1.4 |
| Rez %   | 28.9 | 41.0 | 6.0 | 2.4 |
20. Regulate private (non-tribal) forest practices
- |         |      |      |     |     |
|---------|------|------|-----|-----|
| A       | B    | C    | D   | n/a |
| Total % | 41.3 | 23.9 | 7.9 | 5.9 |
| Rez %   | 54.2 | 20.5 | 4.8 | 4.8 |
21. Survey and permit timber sales for environmental protection
- |         |      |      |     |     |
|---------|------|------|-----|-----|
| A       | B    | C    | D   | n/a |
| Total % | 30.0 | 35.8 | 8.1 | 3.1 |
| Rez %   | 33.7 | 33.7 | 6.0 | 4.8 |
22. Provide for firewood for tribal members
- |         |      |      |      |     |
|---------|------|------|------|-----|
| A       | B    | C    | D    | n/a |
| Total % | 23.8 | 35.5 | 15.7 | 5.1 |
| Rez %   | 32.5 | 37.3 | 12.0 | 4.8 |
23. Emphasize White Pine regeneration
- |         |      |      |     |     |
|---------|------|------|-----|-----|
| A       | B    | C    | D   | n/a |
| Total % | 32.8 | 34.9 | 7.8 | 1.4 |
| Rez %   | 32.5 | 41.0 | 6.0 | 1.2 |

24.	Design timber sales to support tribal employment
	A B C D n/a
	Total % 33.2 32.4 9.5 4.4 20.4
	Rez % 26.5 30.1 16.9 6.0 20.5

## FISHERY

The Bad River is the most conspicuous fishery resource within reservation boundaries. Together with its tributaries, this system provides more than 391 miles of cold and coolwater fish habitat and drains approximately 70,000 acres of reservation land. Major cold water tributaries include the Potato, Tyler Forks, Brunsweller, White, and Marengo rivers. These tributaries contain resident brook and brown trout and provide spawning and nursery areas for coho, chinook and pink salmon, and rainbow and brown trout. The White River and main stem of the Bad River also support spawning runs of walleyes and other coolwater species that migrate into this system from L. Superior. The Bad River slough and Honest John Lake are important spawning and nursery areas for yellow perch and northern pike.

Resident fish species found in the Bad River include: walleye, smallmouth bass, northern pike, yellow perch, rock bass, muskellunge, and white, silver redhorse, shorthead redhorse, and longnose suckers.

The Kakagon River and sloughs are another major fishery resource. Bear Trap and Wood Creeks are the major tributaries. Although this system drains a relatively small watershed, it provides spawning and nursery areas for an anadromous walleye population and other coolwater species as well.

Other species found in the Kakagon River and sloughs include northern pike, yellow perch, black bullhead, smallmouth bass, rock bass, bluegill, pumpkinseed sunfish, black crappie, carp, rainbow smelt, and longnose, white, shorthead redhorse, and silver redhorse suckers.

There is thought to be some fish species living in the inland lake and oxbows that exist within the Bad River flood plain but presently studies have not been done to determine the type of fish or level of population.

Presently, the Tribe only regulates a closed season for Kakagon Sloughs and part of the activity of gill netting by tribal members. The Tribe cannot regulate non-members in this area.

Use the following key to answer questions 25-48

SA = Strongly Agree  
A = Agree  
N = Neutral  
D = Disagree  
SD = Strongly Disagree

- |     |  |      |      |      |     |     |     |
|-----|--|------|------|------|-----|-----|-----|
| 25. | Should the Tribe estimate how many fish are harvested within Reservation waters by tribal members? | SA   | A    | N    | D   | SD  | n/a |
|     | Total %  | 32.1 | 43.1 | 15.8 | 4.1 | 2.7 | 2.1 |
|     | Rez %  | 41.5 | 31.7 | 12.2 | 8.5 | 6.1 | -   |
- 
- |     |   |      |      |     |     |     |     |
|-----|---|------|------|-----|-----|-----|-----|
| 26. | Should the Tribe estimate how many fish are harvested within Reservation waters by non-members? | SA   | A    | N   | D   | SD  | n/a |
|     | Total %   | 54.9 | 31.5 | 7.6 | 2.9 | 1.4 | 1.7 |
|     | Rez %   | 69.5 | 20.7 | 8.5 | 1.2 | -   | -   |
- 
- |     |   |      |      |      |     |     |     |
|-----|---|------|------|------|-----|-----|-----|
| 27. | Should the Tribe prohibit commercial walleye fishing within Reservation boundaries? | SA   | A    | N    | D   | SD  | n/a |
|     | Total %   | 41.0 | 22.7 | 24.0 | 5.6 | 4.0 | 2.7 |
|     | Rez %   | 53.7 | 18.3 | 15.9 | 7.3 | 3.7 | 1.2 |
- 
- |     |  |      |      |      |     |     |     |
|-----|--|------|------|------|-----|-----|-----|
| 28. | Should the Tribe develop harvest quotas for members and non-members to protect on-reservation fisheries resources from over harvest? | SA   | A    | N    | D   | SD  | n/a |
|     | Total %  | 48.6 | 36.5 | 9.0  | 3.0 | 0.6 | 2.3 |
|     | Rez %  | 56.6 | 21.7 | 10.8 | 7.2 | 2.4 | 1.2 |
- 
- |     |   |      |      |     |     |     |     |
|-----|---|------|------|-----|-----|-----|-----|
| 29. | Should the Tribe expand its fish hatchery program to provide additional stocking within Reservation waters? | SA   | A    | N   | D   | SD  | n/a |
|     | Total %   | 48.1 | 38.6 | 8.9 | 1.2 | 0.9 | 2.3 |
|     | Rez %   | 67.1 | 17.1 | 8.5 | 2.4 | 4.9 | -   |
- 
- |     |  |      |      |     |     |     |     |
|-----|--|------|------|-----|-----|-----|-----|
| 30. | Should the Tribe conduct annual contaminant testing on fish that inhabit reservation waters? | SA   | A    | N   | D   | SD  | n/a |
|     | Total %  | 59.5 | 33.0 | 5.2 | 0.3 | 0.1 | 1.9 |
|     | Rez %  | 70.4 | 23.5 | 4.9 | 1.2 | -   | -   |
- 
- |     |   |     |      |      |      |      |     |
|-----|---|-----|------|------|------|------|-----|
| 31. | Do you think the Tribe provides an adequate amount of protection for water quality and fisheries habitat? | SA  | A    | N    | D    | SD   | n/a |
|     | Total %   | 5.9 | 20.1 | 51.7 | 10.0 | 4.7  | 7.6 |
|     | Rez %   | 6.0 | 14.5 | 31.3 | 27.7 | 18.1 | 2.4 |

32. How many meals of fish do you harvest and consume each year from reservation waters?
- |         |      |      |       |       |       |     |     |
|---------|------|------|-------|-------|-------|-----|-----|
|         | 0-5  | 6-10 | 10-20 | 20-30 | 30-40 | 40+ | n/a |
| Total % | 75.2 | 7.7  | 10.7  | 2.0   | 1.3   | -   | 3.1 |
| Rez %   | 40.2 | 11.0 | 39.0  | 6.1   | 3.7   | -   | -   |
33. The Bad River system produces large numbers of parasitic sea lamprey that are harmful to trout and salmon populations. Which of the following sea lamprey control methods is most acceptable to you?
- |  |         |       |
|--|---------|-------|
|  | Total % | Rez % |
| - do nothing   | 1.6     | -     |
| - continue alternate year chemical applications  | 12.7    | 17.1  |
| - increase stocking of sterile male sea lamprey  | 27.6    | 34.1  |
| - construction of one or more lamprey barriers with passage devices that allow other fish to move freely | 48.9    | 45.1  |
| - n/a  | 8.9     | 2.4   |

### WILDLIFE

Most of the Bad River Reservation could be characterized as excellent wildlife habitat. Human influence has been relatively light over most of the reservation, except with regards to timber harvesting. This factor has been the overriding influence on the composition of the reservations flora, and thus on the wildlife species which the flora supports as well. The wildlife species composition on the reservation is similar to that of northern Wisconsin as a whole. Game species include white-tailed deer, ruffed grouse (partridge), black bear, snowshoe hare, grey squirrel, and others. While non-game species include

Breeding waterfowl species, especially mallards, blue-winged teal, black ducks and wood ducks, are found on the Kakagon Sloughs and Honest John Lake area, and on the river oxbows and beaver ponds scattered across the reservation. In addition migratory waterfowl regularly visit the reservation during their yearly journey to and from their northern breeding grounds.

Furbearer species include bobcat, beaver, coyote, raccoon, red fox, mink, muskrat, otter, and fisher, in varying levels of abundance.

34. Should the Tribe determine the amount of game species harvested within Reservation boundaries by tribal members?

	SA	A	N	D	SD	n/a
Total %	32.6	38.4	13.9	3.5	1.7	9.8
Rez %	33.7	26.5	15.7	10.8	7.2	6.0

35. Should the Tribe determine the amount of game species harvested within Reservation boundaries by non-members?

	SA	A	N	D	SD	n/a
Total %	50.0	21.0	6.0	-	1.0	5.0
Rez %	60.2	25.3	7.2	-	1.2	6.0

36. Should the Tribe develop harvest quotas to protect on-reservation wildlife resources from over harvest when necessary?

	SA	A	N	D	SD	n/a
Total %	47.5	34.9	6.0	0.9	0.4	10.4
Rez %	48.2	26.5	12.0	3.6	3.6	6.0

37. Should the Tribe place an stronger emphasis upon the management of game versus non-game wildlife species?

	SA	A	N	D	SD	n/a
Total %	17.4	37.6	26.2	5.7	2.3	10.8
Rez %	21.7	36.1	22.9	9.6	3.6	6.0

38. Should the Tribe conduct annual contaminant testing on wildlife species that inhabit the reservation?

	SA	A	N	D	SD	n/a
Total %	38.3	37.7	10.8	2.4	0.3	10.5
Rez %	59.0	30.1	4.8	-	-	6.0

39. Do you think the Tribe provides an adequate amount of protection for wildlife populations

	SA	A	N	D	SD	n/a
Total %	5.0	23.9	43.0	10.4	3.8	13.8
Rez %	4.8	24.1	25.3	21.7	18.1	6.0

40. In an average year, how many meals do you consume of wildlife species harvested on-reservation?  
(The choices provided for this question were worded incorrectly and thus cannot be used)

41. Should the Tribe manage its wildlife and timber resources in a manner that maximizes game species?

	SA	A	N	D	SD	n/a
Total %	28.5	39.2	16.3	3.4	1.7	10.9
Rez %	32.5	39.8	14.5	4.8	2.4	6.0

42. Should the Tribe manage its wildlife and timber resources in a manner that maximizes biological diversity?

	SA	A	N	D	SD	n/a
Total %	25.4	37.5	22.5	2.3	1.0	11.3
Rez %	28.9	39.8	19.3	1.2	3.6	7.2

43. In an average year, how many pounds of finished wild rice do you harvest for consumption?

	0-10	10-20	20-30	30-50	50+	n/a
Total %	71.5	6.4	4.1	2.7	3.0	12.3
Rez %	37.3	13.3	10.8	12.0	19.3	7.2

44. Should the Tribe provide a higher level of environmental protection to the Kakagon and Bad River Sloughs?

	SA	A	N	D	SD	n/a
Total %	41.5	33.6	13.3	0.4	0.3	10.9
Rez %	67.5	18.1	7.2	-	1.2	6.0

45. Should the Tribe attempt to re-establish harvestable quantities of wild rice within the Bad River Slough?

	SA	SA	N	D	SD	n/a
Total %	35.6	40.1	17.1	2.5	1.7	3.0
Rez %	45.1	32.9	11.0	4.9	4.9	1.2

46. In an average year, how many times do you harvest wild plants for medicinal or ceremonial purposes? (Check One)

	0	1-10	11-20	21-30	30+	n/a
Total %	78.8	15.7	1.1	0.6	0.7	3.1
Rez %	53.1	35.8	4.9	1.2	1.2	3.7

47. Is the preservation of threatened, endangered, medicinal, or Ceremonial plants more important than taking advantage of available timber harvest and/or economic development opportunities?

	SA	A	N	D	SD	n/a
Total %	26.6	26.1	36.6	4.1	2.7	3.8
Rez %	19.5	40.2	29.3	3.7	4.9	2.4

48. Should the Tribe support the re-introduction of species which has historically occurred in this region (woodland caribou, moose, elk, wolf, etc.)?

	SA	A	N	D	SD	n/a
Total %	32.3	35.4	18.3	7.1	4.6	2.3
Rez %	29.6	25.9	23.5	11.1	7.4	2.5

#### LAND USE

The Bad River Reservation, established by the Treaty of 1854 with the United States Government, originally encompassed 124,334.50 acres of land, of which 115,968 acres were allotted to 1610 individuals. By 1971, only 54,912 acres were held by the Tribe (8,325), Federal Government (13,110), and individual allottees (33,477). Today the Tribe possesses 24,246.73 acres of trust lands including 196 acres on Madeline Island.

The Tribe also owns approximately 5,430.45 acres of alienated (taxable) lands within the Reservation boundaries and 120 acres outside the Reservation. Much of these taxable properties are in Wisconsin's State Forest Crop Law Program. The amount of allotted and individual trust holding amount to 33,043.09 acres. This total amount of 62,840.27 acres of tribal trust/fee land and allotted land represents 51% of the original land base of the Bad River Band. This leaves 61,494.23 acres or 49% of the land in the control of private owners, the majority being non-Indian.

Of the total Reservation acreage, roughly 70% of the acres are managed forest lands, 10% are part of the wetlands making up the Kakagon and Bad River Sloughs system and the remaining 20% are used for residential, recreational, commercial and industrial purposes.

Please grade the following possible Realty/Land Use goals for the Bad River Reservation.

Grade	Level of Importance				
	A	B	C	D	E
Extremely important goal.					
Important goal.					
Somewhat important goal.					
Not an important goal.					
This is not a desirable goal and should be dropped.					

49. Develop and implement a Tribal Land Acquisition/Consolidation

	A	B	C	D	E	n/a
Total %	38.1	30.4	13.9	3.1	1.8	12.5
Rez %	48.8	28.0	11.0	2.4	1.2	8.5

50. Plan for alienated lands within the Reservation.

	A	B	C	D	E	n/a
Total %	21.2	33.1	22.5	5.0	2.4	15.8
Rez %	31.7	35.4	13.4	2.4	2.4	14.6

51. Set aside natural areas for preservation and traditional use.

A	B	C	D	E	n/a
Total %	55.8	29.3	5.8	1.0	0.3
Rez %	54.9	26.8	9.8	2.4	6.1

52. Set aside commercial areas for economic development.

A	B	C	D	E	n/a
Total %	29.9	34.0	17.5	6.4	3.0
Rez %	43.9	28.0	12.2	7.3	2.4

53. Identify and protect significant archaeological/historical sites.

A	B	C	D	E	n/a
Total %	61.6	23.3	6.0	1.4	0.3
Rez %	61.0	25.6	6.1	2.4	1.2

54. Develop a land-use plan to guide development activities.

A	B	C	D	E	n/a
Total %	42.0	31.9	12.7	2.8	0.7
Rez %	39.0	35.4	13.4	1.2	1.2

55. Other \_\_\_\_\_

56. Should specific areas of the reservation be designated for specific uses, such as residential, business, industrial, recreation, etc...?

Yes	No	n/a
Total %	77.1	10.9
Rez %	82.7	8.6

57. Would you be in favor of designating some lake shore property on the reservation for a large tourist development?

Yes	No	n/a
Total %	51.8	34.5
Rez %	49.4	37.0

58. If yes, what type of development would you prefer?

	Tribal #	Rez #
Casino	182	14
Convention Center	85	15
Golf course	81	10
Hotel	151	22
Marina	179	25
Resort	185	21
Other _____	49	3

59. Should Tribal members pay a flat rate or a variable per/acre fee (which reflects the market value) for their leases?

Flat rate	Per acre fee	n/a
Total %	34.2	43.4
Rez %	48.2	31.3

#### UNIQUE AREAS

The Bad River reservation contains a number of potential areas that consist of critical habitat and support a wide range of biological diversity. The Tribe has considered setting these areas aside as natural areas where negative environmental impacts would be kept to a minimum.

60. For the areas listed below indicate by a check if you think this type of designation would be appropriate.

	Tribal #	Rez #
Bad River & corridor	365	53
Graveyard Creek & corridor	258	39
Kakagon sloughs, Oak Point & Lakeshore	372	63
Lake Superior shoreline	341	46
Madeline Island Property	328	39
Old Growth Forests	136	18
Tribal Wilderness area	120	18
Other _____		

#### ENVIRONMENTAL QUALITY

The Bad River reservation has been blessed with unusually high quality water, air, and land. Unfortunately the land is beginning to show the effects of man presence on it and the quality of the environment is slowly deteriorating.

61. Jurisdictional authority, legal responsibilities and financial support for environmental protection currently are shared by a number of Federal, State and Tribal entities. Who should have the primary responsibility and authority for the environmental protection of the Reservation?

	Total %	Rez %
Tribe as primary authority	74.2	79.5
Federal Government (BIA/EPA) as primary authority	9.2	9.6
State of Wisconsin (WDNR) as primary authority	4.4	3.6
n/a	12.2	7.2

Rank the following environmental issues.

1. - Extremely serious
2. - Fairly serious
3. - Not Important
4. - Not enough information

62. Leaking landfills, Illegal dumping

	1	2	3	4	n/a
Total %	81.8	8.0	0.4	2.8	6.2
Rez %	86.7	9.6	-	1.2	2.4

63. Underground storage tanks / contaminated drinking water

	1	2	3	4	n/a
Total %	77.9	10.5	0.6	3.4	7.6
Rez %	85.5	9.6	-	-	4.8

64. Sewage contamination of drinking water

	1	2	3	4	n/a
Total %	81.5	7.2	0.4	3.5	7.4
Rez %	89.2	6.0	-	1.2	3.6

65. Off-Reservation pollution sources

	1	2	3	4	n/a
Total %	51.9	30.4	1.4	6.9	9.3
Rez %	57.8	31.3	-	4.8	6.0

66. Paper-Mill Sludge Dumps / contaminated drinking water

	1	2	3	4	n/a
Total %	79.8	8.9	0.6	3.8	6.9
Rez %	94.0	3.6	-	-	2.4

67. Chemical/Herbicide/Pesticide Use

	1	2	3	4	n/a
Total %	57.1	27.3	1.4	6.2	7.9
Rez %	63.9	26.5	1.2	4.8	3.6

68. Outdoor Air pollution / Garbage burning

	1	2	3	4	n/a
Total %	26.0	40.5	17.3	7.4	8.9
Rez %	19.3	47.0	18.1	9.6	6.0

69. Clearcutting as it effects water quality/Endangered species

	1	2	3	4	n/a
Total %	54.6	27.9	4.4	5.0	8.2
Rez %	61.4	27.7	3.6	3.6	3.6

70. Hazardous material transportation through reservation

	1	2	3	4	n/a
Total %	41.2	29.1	11.7	10.0	7.9
Rez %	50.6	34.9	3.6	7.2	3.6

71. Indoor air pollution / Second hand smoke

	1	2	3	4	n/a
Total %	29.4	27.6	25.2	9.1	8.8
Rez %	30.1	37.3	16.9	9.6	6.0

72. Outdoor Air Pollution / Woodstoves

	1	2	3	4	n/a
Total %	13.7	28.3	38.3	9.9	9.8
Rez %	13.3	25.3	39.8	15.7	6.0

73. Exotic Species, (purple loosestrife, lamprey, carp, river hufe, etc.)

	1	2	3	4	n/a
Total %	39.0	34.1	5.9	12.4	8.5
Rez %	61.4	21.7	3.6	8.4	4.8

74. Habitat Fragmentation from logging, roads, utility corridors, etc.

	1	2	3	4	n/a
Total %	29.6	36.8	10.3	12.2	11.2
Rez %	34.9	36.1	8.4	13.3	7.2

75. Other



Rez %	A	B	C	D	E	n/a
89. Balsam bough gather.	15.7	13.3	34.9	14.5	3.6	18.1
90. Bark collecting	12.0	9.6	37.3	14.5	4.8	21.7
91. Berry picking	28.9	24.1	30.1	2.4	-	14.5
92. Community gardening	20.5	20.5	26.5	9.6	3.6	19.3
93. Fur Trapping	4.8	21.7	31.3	10.8	8.4	22.9
94. Gathering edible nuts	9.6	22.9	34.9	8.4	2.4	21.7
95. Maple Syrup collection	41.0	32.5	10.8	1.2	-	14.5
96. Plant gathering	27.7	22.9	20.5	4.8	1.2	22.9
97. Pow-wows	56.6	19.3	8.4	-	-	15.7
98. Ricing	66.3	13.3	6.0	-	-	14.5
99. Spiritual activities	50.6	16.9	13.3	1.2	-	18.1

Rez %	A	B	C	D	E	n/a
103. Beach combing	11.0	13.7	29.1	16.0	4.7	25.5
104. Bicycle riding	15.1	25.3	27.7	6.6	1.4	23.8
105. Group camping	16.5	27.7	24.5	5.9	1.4	23.9
106. Camping (trailer/RV)	12.7	23.2	28.7	7.9	3.0	24.5
107. Canoe/Kayaking	20.1	29.8	21.8	3.8	1.0	23.5
108. Sledding/toboggan	12.7	24.2	30.3	6.2	1.6	25.0
109. X-country skiing	13.9	24.5	28.6	6.2	1.8	25.0
110. Cutting Firewood	11.9	21.6	28.9	8.9	2.8	25.9
111. Down hill skiing	6.6	17.4	29.6	17.3	3.1	26.0
112. Fishing	39.3	29.1	8.9	0.4	0.6	21.6
113. Hunting (firearm)	28.1	23.3	16.5	4.8	4.7	22.5
114. Hunting (bow)	29.3	25.3	14.9	3.7	3.1	23.8
115. Hiking/walking	32.7	25.9	15.4	2.3	1.0	22.8
116. Horseback riding	15.4	20.9	25.6	10.7	2.3	25.0
117. Ice skating	14.1	23.1	28.3	8.3	1.7	24.5
118. Ice fishing	24.0	31.1	18.5	2.0	1.0	23.3
119. Lacrosse	12.3	18.8	25.7	11.5	3.3	28.4
120. Outdoor Swimming	24.0	26.7	20.7	3.5	1.3	23.8
121. Power boating	5.0	13.4	25.6	19.5	11.6	24.9
122. Picnicing	25.9	29.0	17.8	3.4	0.8	23.1
123. Snowmobiling	8.8	18.0	26.6	15.1	7.2	24.3
124. Snowshoeing	17.3	28.6	23.2	5.7	0.8	24.5
125. Sail boating	8.6	17.7	28.4	15.0	4.7	25.6
126. Target/Trap shooting	8.2	15.8	24.5	17.4	8.1	26.0
127. Water skiing	4.4	12.3	30.8	18.8	7.9	25.7
128. 4 wheeling	7.2	9.1	21.4	20.8	17.8	23.8

### RECREATIONAL RESOURCES

The Bad River reservation presently provides both land based and water based recreational opportunities to the tribal members. Land based opportunities consist of two softball fields (one lighted), three outdoor basketball courts (two lighted), one campground, hiking and hunting areas. Water based opportunities consist of fishing, boating, canoeing, and swimming.

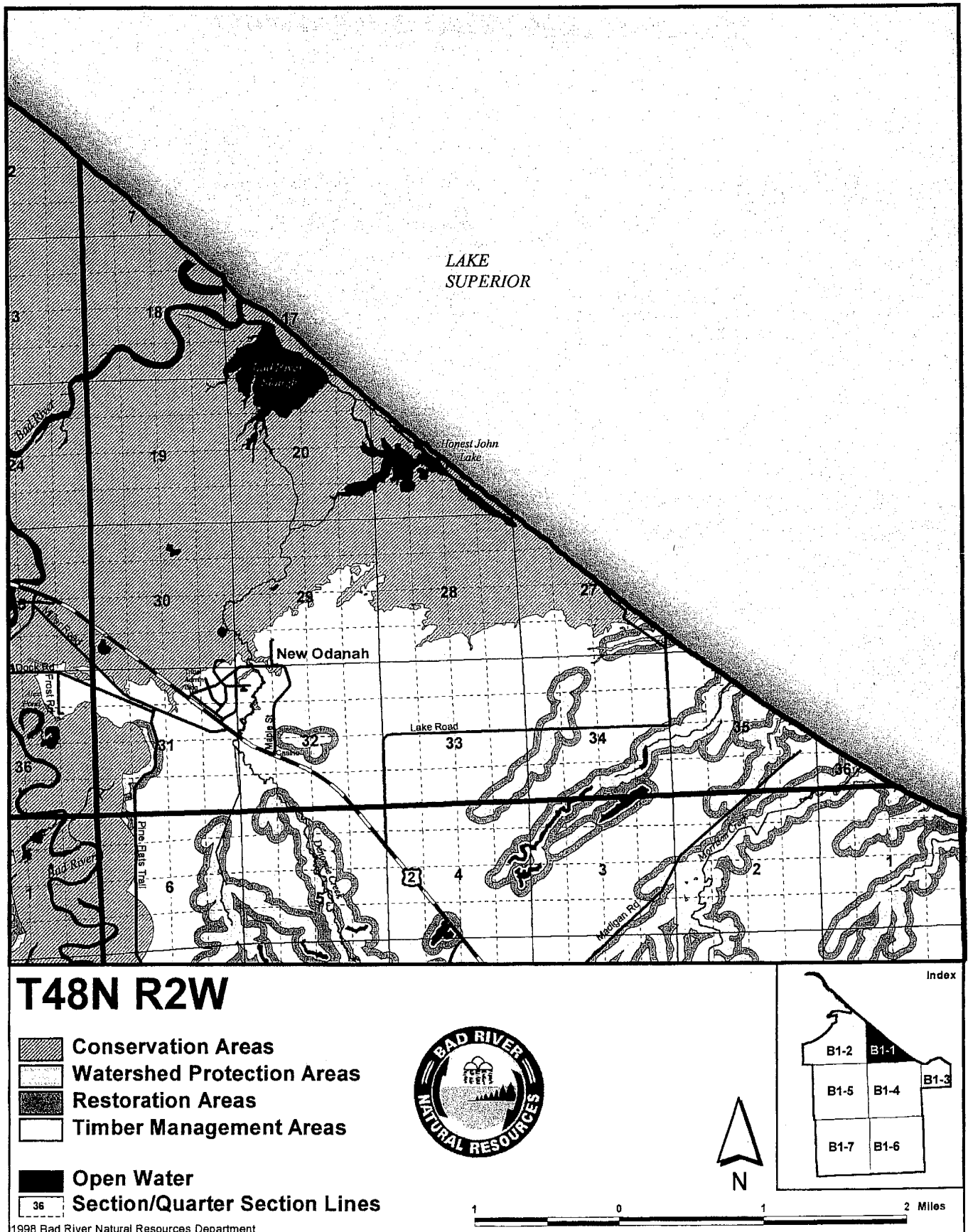
101. What recreational activity do you most enjoy? \_\_\_\_\_

What recreational activity do you think the Tribe should provide and encourage the membership to participate in? Please indicate your decision by grading the importance of each activity below.

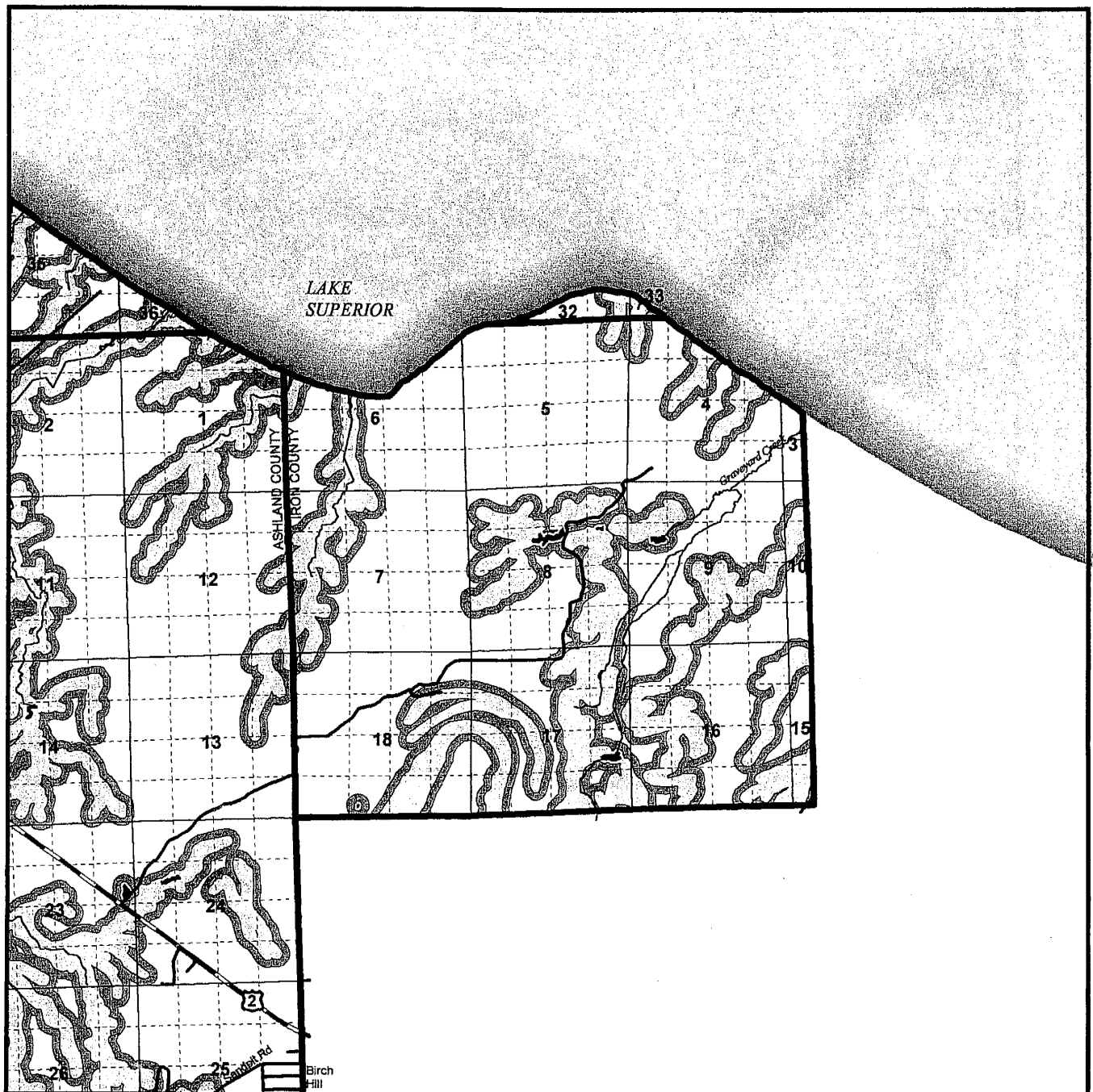
#### Grade Level of Importance

- A This activity is very important and should be encouraged.
- B This activity is important and should be encourage.
- C This activity is somewhat important.
- D This is not an important activity..
- E This is not a desirable activity and should be dropped.







**APPENDIX B. RESOURCE MANAGEMENT AREAS**

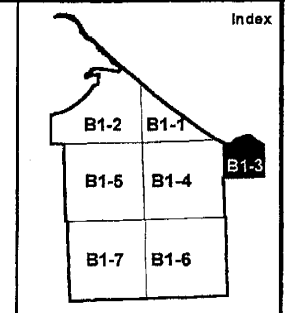


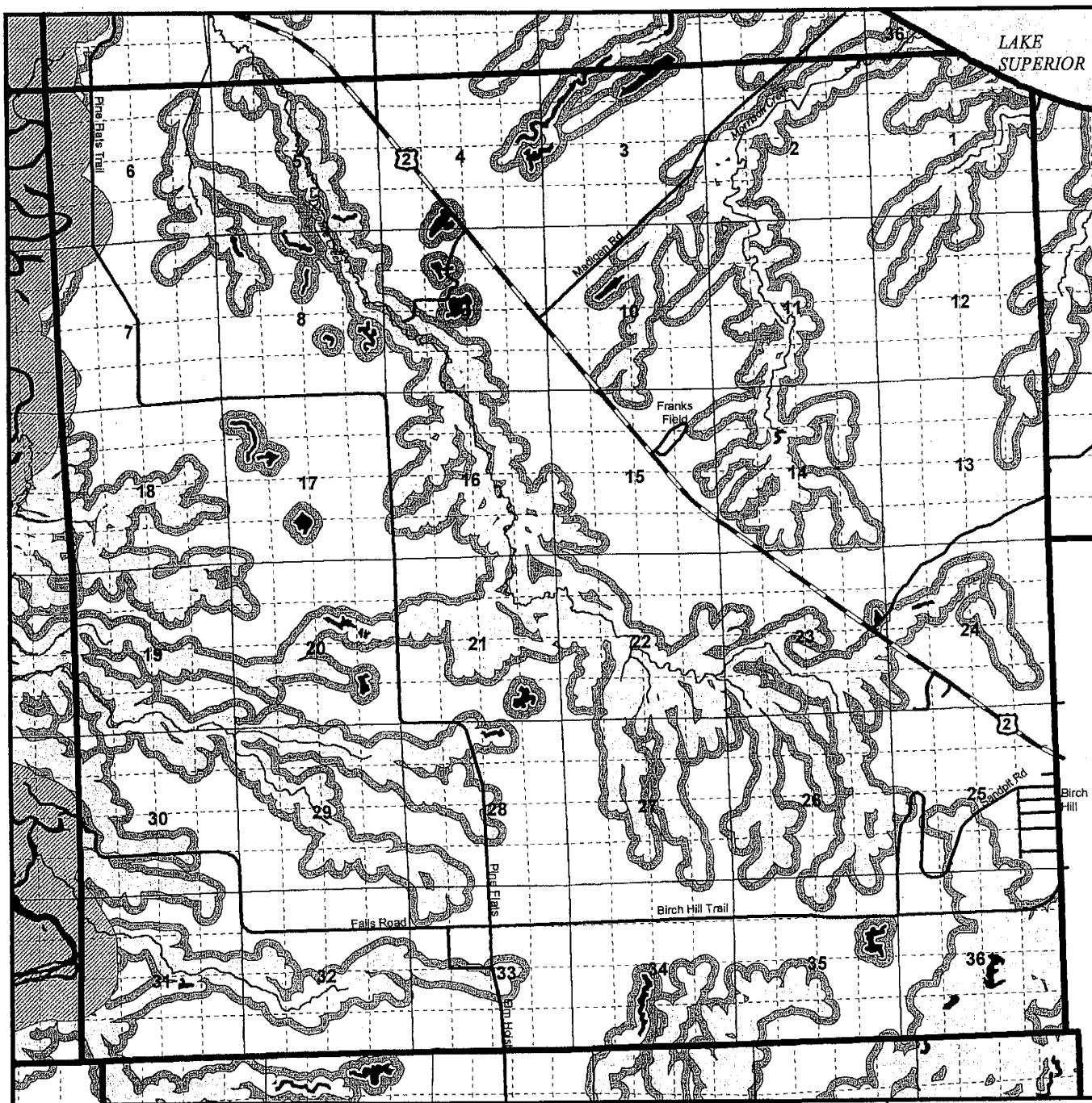










**T47N R1W, T48N R1W**

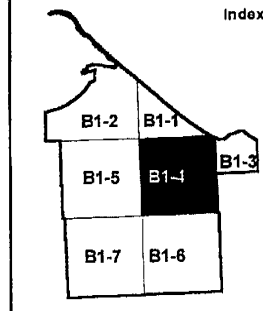
-  Conservation Areas
-  Watershed Protection Areas
-  Restoration Areas
-  Timber Management Areas
-  Open Water
-  Section/Quarter Section Lines

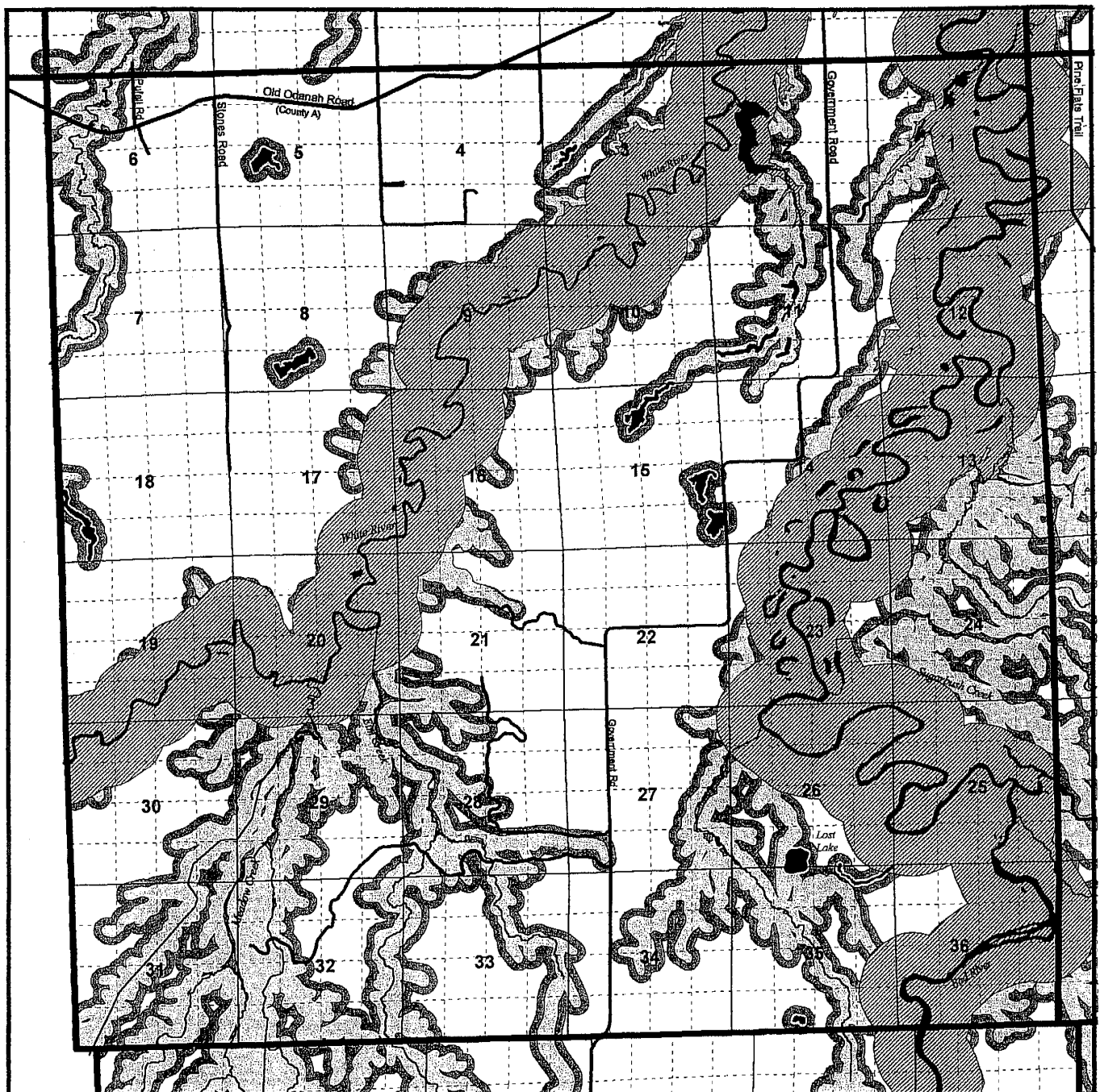










**T47N R2W**

-  Conservation Areas
-  Watershed Protection Areas
-  Restoration Areas
-  Timber Management Areas
-  Open Water
-  Section/Quarter Section Lines



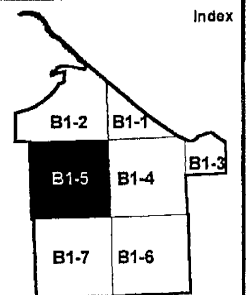


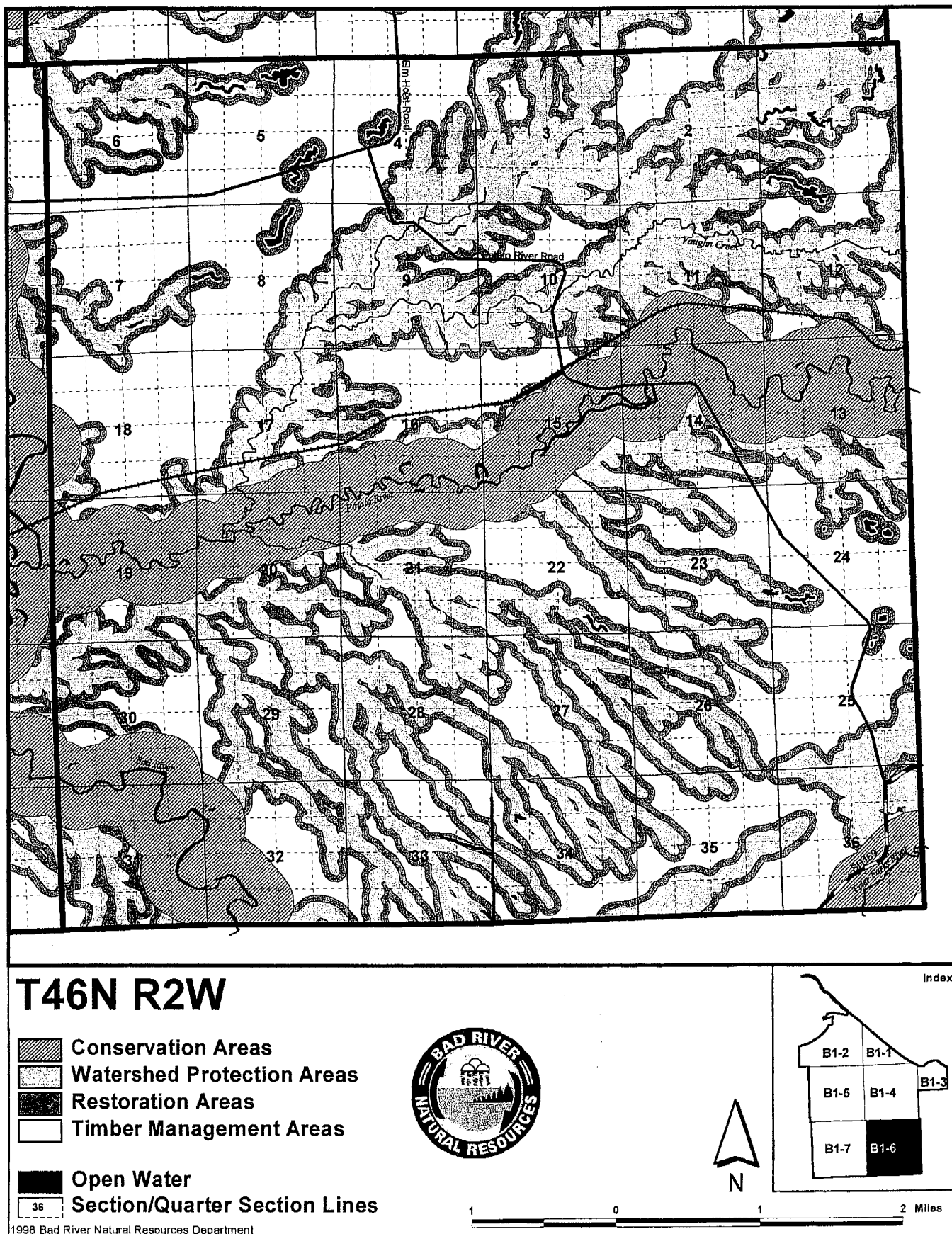
**T47N R3W**

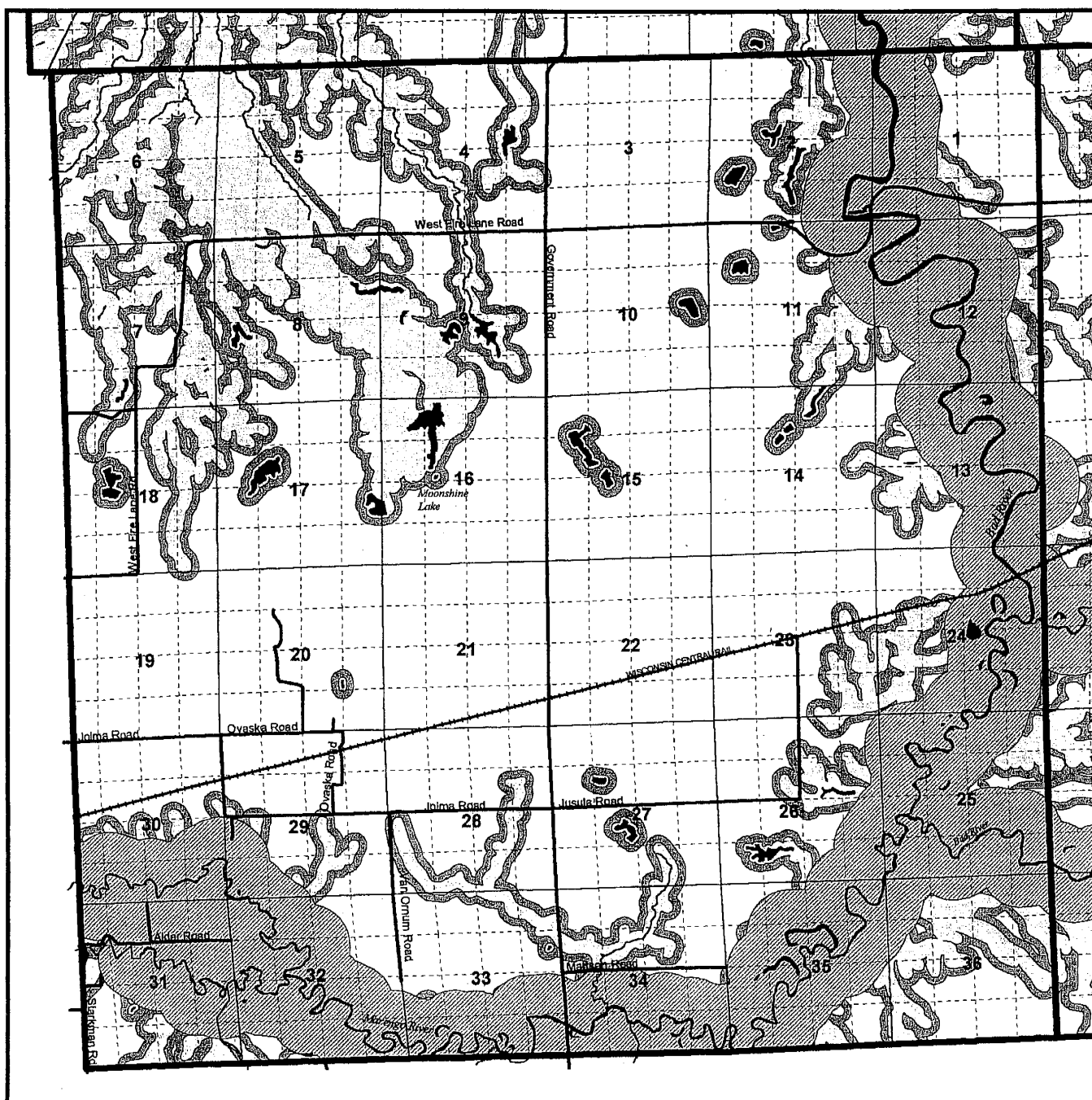
-  Conservation Areas
-  Watershed Protection Areas
-  Restoration Areas
-  Timber Management Areas
-  Open Water
-  Section/Quarter Section Lines









1 0 1 2 Miles

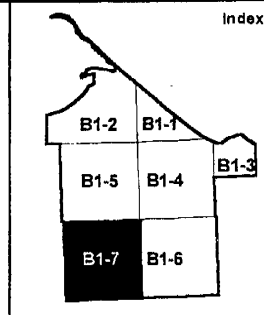






**T46N R3W**

-  Conservation Areas
-  Watershed Protection Areas
-  Restoration Areas
-  Timber Management Areas
-  Open Water
-  Section/Quarter Section Lines



**APPENDIX C. STATISTICAL SUMMARY OF BAD RIVER RESERVATION**  
**NATURAL RESOURCES**

## Appendix C: Statistical Summary of Bad River Reservation Natural Resources

The following is a compilation of statistics derived by GIS analysis of land ownership, vegetative cover (and generalized vegetative cover), landtypes IRMP Resource Management Areas.

Some table values have been rounded to facilitate interpretation. Open water categories have been eliminated from most tables to provide more meaningful statistical values.

### Inputs

Title	Scale	Source
Land ownership	1:24,000	BIA and BRNRD records
Vegetation cover	1:15,840	BRNRD from air photo interpretation
Generalized vegetative cover	1:15,840	Cover types grouped from above
Landtypes	1:20,000	NRCS soil map unit groupings
Resource Management Areas	1:24,000	IRMP ID-Team

### Tables

Ownership .....	C1-2
Vegetation cover.....	C1-3
Landtypes and Resource Management Areas.....	C1-4
Vegetative Cover vs. Land Ownership .....	C1-5
Vegetative Cover vs. Land Ownership (cont.) .....	C1-6
Generalized Vegetative Cover vs. Land Ownership .....	C1-7
Landtypes vs. Land Ownership .....	C1-8
Resource Management Areas vs. Land Ownership .....	C1-9
Resource Management Areas vs. Vegetative Cover .....	C1-10
Resource Management Areas vs. Vegetative Cover (cont.).....	C1-11
Resource Management Areas vs. Generalized Vegetative Cover.....	C1-12
Resource Management Areas vs. Landtypes.....	C1-13
Landtypes vs. Vegetative Cover.....	C1-14
Landtypes vs. Vegetative Cover (cont.).....	C1-15
Landtypes vs. Generalized Vegetative Cover.....	C1-16

## Ownership

### Land ownership breakdown

Owner	Acres	% of Total
Tribal	22,795	18.3
Trib Fee	6,565	5.3
Allotted	36,900	29.6
Alienated	58,390	46.8
Total	124,650	100.0

Tribal Total	66,260	53.2
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### Definitions of land ownership categories

#### Tribal

Lands held by Tribe in trust.

#### Tribal Fee

Lands held by the Tribe which have been reacquired from alienated status.

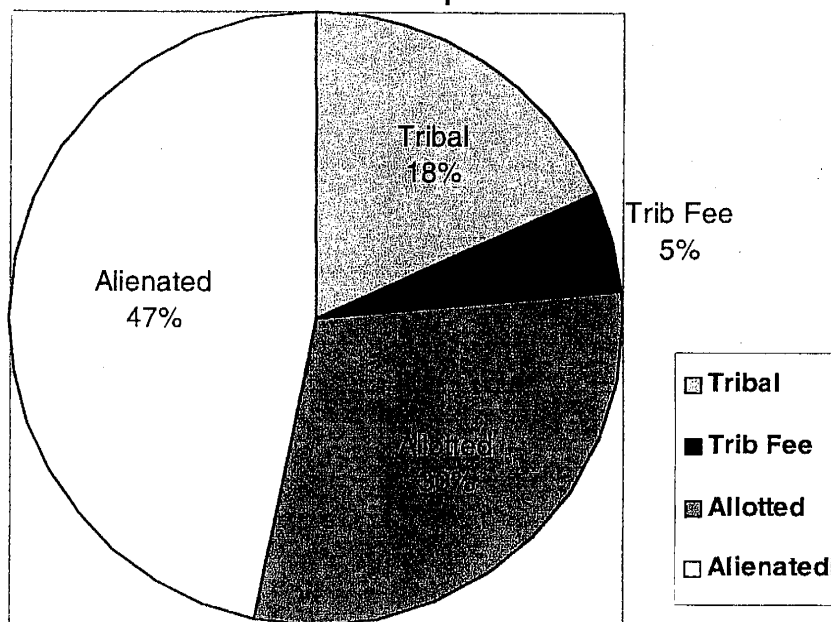
#### Allotted

Lands which are held in trust for individual allottees.

#### Alienated

Lands which are owned privately.

Land ownership acres



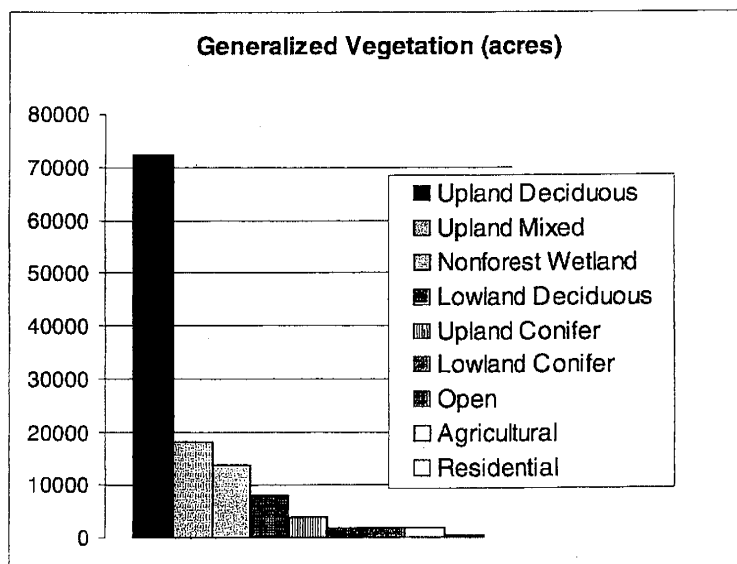
## Vegetation cover

### Detailed Vegetation Cover

Description	Generalized Cover	Acres	% of Total
Aspen-Red Maple Forest	Upland Deciduous	34,054	27.4
Boreal Hardwood-Conifer Forest	Upland Mixed	17,850	14.4
Aspen Clearcut	Upland Deciduous	15,535	12.5
Aspen Forest	Upland Deciduous	10,983	8.8
Northern Hardwood Forest	Upland Deciduous	9,287	7.5
Alder Thicket	Nonforest Wetland	7,523	6.0
Sugar Maple-Basswood Forest	Lowland Deciduous	3,241	2.6
Northern Sedge Meadow	Nonforest Wetland	2,990	2.4
Mixed Hardwood Swamp	Lowland Deciduous	2,587	2.1
Open Bog	Nonforest Wetland	1,667	1.3
Agricultural	Agricultural	1,666	1.3
Black Ash Swamp	Lowland Deciduous	1,618	1.3
Aspen-Birch Forest	Upland Deciduous	1,608	1.3
Mixed Conifer Forest	Upland Conifer	1,555	1.3
Red Pine Forest	Upland Conifer	1,412	1.1
Tamarack Swamp	Lowland Conifer	1,294	1.0
Willow Thicket	Nonforest Wetland	906	0.7
Oak Forest	Upland Deciduous	870	0.7
Upland Brush	Open	750	0.6
White Pine Forest	Upland Conifer	746	0.6
Upland Meadow	Open	677	0.5
Silver Maple-Boxelder Forest	Lowland Deciduous	599	0.5
Aquatic	Nonforest Wetland	580	0.5
Spruce-Fir Forest	Lowland Conifer	407	0.3
Residential	Residential	371	0.3
Sand	Open	331	0.3
Pine-Birch-Oak Forest	Upland Mixed	261	0.2
Swamp Conifer Forest	Lowland Conifer	158	0.1
Upland White Cedar Forest	Upland Conifer	131	0.1
Sandbar Meadow	Open	100	0.1

### Generalized vegetation cover

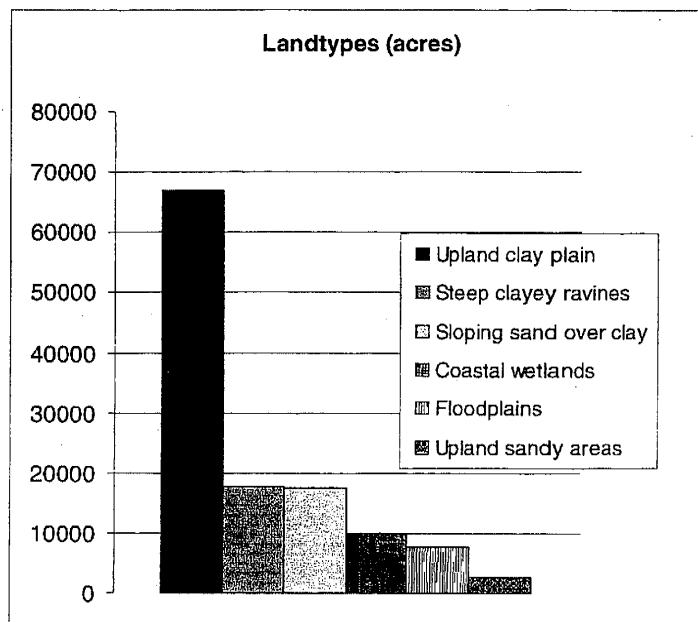
Generalized Cover	Acres	% of Total
Upland Deciduous	72338	58.2
Upland Mixed	18111	14.6
Nonforest Wetland	13666	11.0
Lowland Deciduous	8045	6.5
Upland Conifer	3844	3.1
Lowland Conifer	1859	1.5
Open	1858	1.5
Agricultural	1666	1.3
Residential	371	0.3



## Landtypes and Resource Management Areas

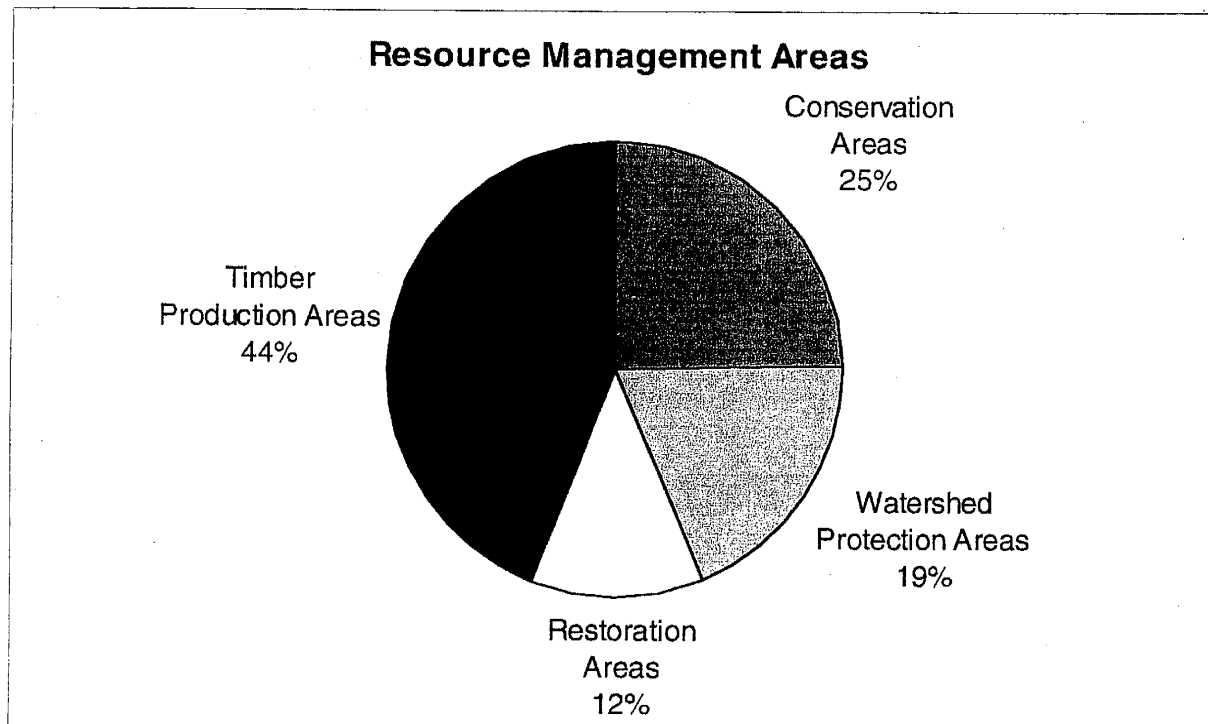
### Landtype

Landtype	Total	% of Total
Upland clay plain	66817	55
Steep clayey ravines	17646	14
Sloping sand over clay	17472	14
Coastal wetlands	9887	8
Floodplains	7885	6
Upland sandy areas	2784	2



### Resource Management Areas

RMA	Acres	% of Total
Conservation Areas	30,185	24.7
Watershed Protection Areas	23,260	19.0
Restoration Areas	14,688	12.0
Timber Production Areas	54,174	44.3



## Vegetative Cover vs. Land Ownership

*Vegetation cover vs. land ownership (acres)*

Description	Tribal	Trib Fee	Allotted	Alienated	
Aspen-Red Maple Forest	5,714	2,195	11,525	14,620	34,054
Boreal Hardwood-Conifer Forest	3,566	661	5,587	8,036	17,850
Aspen Clearcut	2,479	1,344	1,868	9,845	15,535
Aspen Forest	1,314	545	4,047	5,077	10,983
Northern Hardwood Forest	1,593	537	2,689	4,468	9,287
Alder Thicket	1,431	496	2,469	3,127	7,523
Sugar Maple-Basswood Forest	309	19	916	1,999	3,241
Northern Sedge Meadow	845	37	1,408	699	2,990
Open Water	493	121	939	1,047	2,601
Mixed Hardwood Swamp	442	63	869	1,212	2,587
Open Bog	950	1	516	200	1,667
Agricultural	0	0	41	1,625	1,666
Black Ash Swamp	234	63	621	700	1,618
Aspen-Birch Forest	161	76	416	956	1,609
Mixed Conifer Forest	229	65	267	995	1,555
Red Pine Forest	298	18	340	756	1,413
Tamarack Swamp	898		319	77	1,294
Willow Thicket	132	25	242	508	906
Oak Forest	123	4	287	456	870
Upland Brush	115	0	101	534	750
White Pine Forest	413	6	65	262	746
Upland Meadow	54	55	102	466	677
Silver Maple-Boxelder Forest	148		183	268	599
Aquatic	150		378	52	580
Spruce-Fir Forest	4	16	38	350	407
Residential	240		22	108	371
Sand	7		13	310	331
Pine-Birch-Oak Forest	15		155	92	261
Swamp Conifer Forest	6	2	121	30	158
Upland White Cedar Forest	68	2	19	42	131
Sandbar Meadow	26		18	57	100
	22,454	6,350	36,582	58,973	124,359

*Percent ownership in vegetation cover*

Description	Tribal	Trib Fee	Allotted	Alienated
Aspen-Red Maple Forest	25.4	34.6	31.5	24.8
Boreal Hardwood-Conifer Forest	15.9	10.4	15.3	13.6
Aspen Clearcut	11.0	21.2	5.1	16.7
Aspen Forest	5.9	8.6	11.1	8.6
Northern Hardwood Forest	7.1	8.5	7.4	7.6
Alder Thicket	6.4	7.8	6.7	5.3
Sugar Maple-Basswood Forest	1.4	0.3	2.5	3.4
Northern Sedge Meadow	3.8	0.6	3.8	1.2
Open Water	2.2	1.9	2.6	1.8
Mixed Hardwood Swamp	2.0	1.0	2.4	2.1
Open Bog	4.2	0.0	1.4	0.3
Agricultural	0.0	0.0	0.1	2.8
Black Ash Swamp	1.0	1.0	1.7	1.2
Aspen-Birch Forest	0.7	1.2	1.1	1.6
Mixed Conifer Forest	1.0	1.0	0.7	1.7
Red Pine Forest	1.3	0.3	0.9	1.3
Tamarack Swamp	4.0	0.0	0.9	0.1
Willow Thicket	0.6	0.4	0.7	0.9
Oak Forest	0.5	0.1	0.8	0.8
Upland Brush	0.5	0.0	0.3	0.9
White Pine Forest	1.8	0.1	0.2	0.4
Upland Meadow	0.2	0.9	0.3	0.8
Silver Maple-Boxelder Forest	0.7	0.0	0.5	0.5
Aquatic	0.7	0.0	1.0	0.1
Spruce-Fir Forest	0.0	0.2	0.1	0.6
Residential	1.1	0.0	0.1	0.2
Sand	0.0	0.0	0.0	0.5
Pine-Birch-Oak Forest	0.1	0.0	0.4	0.2
Swamp Conifer Forest	0.0	0.0	0.3	0.1
Upland White Cedar Forest	0.3	0.0	0.1	0.1
Sandbar Meadow	0.1	0.0	0.0	0.1
	100	100	100	100

Total Tribal
29.7
15.0
8.7
9.0
7.4
6.7
1.9
3.5
2.4
2.1
2.2
0.1
1.4
1.0
0.9
1.0
1.9
0.6
0.6
0.3
0.7
0.3
0.5
0.8
0.1
0.4
0.0
0.3
0.2
0.1
0.1
100

e.g., 30% of tribal lands  
are Aspen-Red Maple

## Vegetative Cover vs. Land Ownership (cont.)

### Percent vegetation cover under ownership

Description	Tribal	Trib Fee	Allotted	Alienated		Total Tribal	
Aspen-Red Maple Forest	17	6	34	43	100	57	e.g., 57% of aspen-red maple forest is tribally owned
Boreal Hardwood-Conifer Forest	20	4	31	45	100	55	
Aspen Clearcut	16	9	12	63	100	37	
Aspen Forest	12	5	37	46	100	54	
Northern Hardwood Forest	17	6	29	48	100	52	
Alder Thicket	19	7	33	42	100	58	
Sugar Maple-Basswood Forest	10	1	28	62	100	38	
Northern Sedge Meadow	28	1	47	23	100	77	
Open Water	19	5	36	40	100	60	
Mixed Hardwood Swamp	17	2	34	47	100	53	
Open Bog	57	0	31	12	100	88	
Agricultural	0	0	2	98	100	2	
Black Ash Swamp	14	4	38	43	100	57	
Aspen-Birch Forest	10	5	26	59	100	41	
Mixed Conifer Forest	15	4	17	64	100	36	
Red Pine Forest	21	1	24	54	100	46	
Tamarack Swamp	69	0	25	6	100	94	
Willow Thicket	15	3	27	56	100	44	
Oak Forest	14	0	33	52	100	48	
Upland Brush	15	0	14	71	100	29	
White Pine Forest	55	1	9	35	100	65	
Upland Meadow	8	8	15	69	100	31	
Silver Maple-Boxelder Forest	25	0	31	45	100	55	
Aquatic	26	0	65	9	100	91	
Spruce-Fir Forest	1	4	9	86	100	14	
Residential	65	0	6	29	100	71	
Sand	2	0	4	94	100	6	
Pine-Birch-Oak Forest	6	0	59	35	100	65	
Swamp Conifer Forest	4	1	77	19	100	81	
Upland White Cedar Forest	52	1	15	32	100	68	
Sandbar Meadow	26	0	18	56	100	44	

### Percent of the whole

Description	Tribal	Trib Fee	Allotted	Alienated		Total Tribal	
Aspen-Red Maple Forest	4.6	1.8	9.3	11.8		15.6	e.g., of entire rez, 15% is tribally owned aspen-red maple forest
Boreal Hardwood-Conifer Forest	2.9	0.5	4.5	6.5		7.9	
Aspen Clearcut	2.0	1.1	1.5	7.9		4.6	
Aspen Forest	1.1	0.4	3.3	4.1		4.7	
Northern Hardwood Forest	1.3	0.4	2.2	3.6		3.9	
Alder Thicket	1.2	0.4	2.0	2.5		3.5	
Sugar Maple-Basswood Forest	0.2	0.0	0.7	1.6		1.0	
Northern Sedge Meadow	0.7	0.0	1.1	0.6		1.8	
Open Water	0.4	0.1	0.8	0.8		1.2	
Mixed Hardwood Swamp	0.4	0.1	0.7	1.0		1.1	
Open Bog	0.8	0.0	0.4	0.2		1.2	
Agricultural	0.0	0.0	0.0	1.3		0.0	
Black Ash Swamp	0.2	0.1	0.5	0.6		0.7	
Aspen-Birch Forest	0.1	0.1	0.3	0.8		0.5	
Mixed Conifer Forest	0.2	0.1	0.2	0.8		0.5	
Red Pine Forest	0.2	0.0	0.3	0.6		0.5	
Tamarack Swamp	0.7	0.0	0.3	0.1		1.0	
Willow Thicket	0.1	0.0	0.2	0.4		0.3	
Oak Forest	0.1	0.0	0.2	0.4		0.3	
Upland Brush	0.1	0.0	0.1	0.4		0.2	
White Pine Forest	0.3	0.0	0.1	0.2		0.4	
Upland Meadow	0.0	0.0	0.1	0.4		0.2	
Silver Maple-Boxelder Forest	0.1	0.0	0.1	0.2		0.3	
Aquatic	0.1	0.0	0.3	0.0		0.4	
Spruce-Fir Forest	0.0	0.0	0.0	0.3		0.0	
Residential	0.2	0.0	0.0	0.1		0.2	
Sand	0.0	0.0	0.0	0.2		0.0	
Pine-Birch-Oak Forest	0.0	0.0	0.1	0.1		0.1	
Swamp Conifer Forest	0.0	0.0	0.1	0.0		0.1	
Upland White Cedar Forest	0.1	0.0	0.0	0.0		0.1	
Sandbar Meadow	0.0	0.0	0.0	0.0		0.0	

## Generalized Vegetative Cover vs. Land Ownership

*Generalized vegetation vs. land ownership (acres)*

General Cover	Tribal	Trib Fee	Allotted	Alienated	
Upland Deciduous	11,383	4,700	20,832	35,422	72,338
Upland Mixed	3,580	661	5,742	8,128	18,111
Nonforest Wetland	3,508	560	5,013	4,586	13,666
Lowland Deciduous	1,132	144	2,589	4,179	8,045
Upland Conifer	1,007	91	691	2,055	3,845
Lowland Conifer	908	17	478	456	1,859
Open	202	55	235	1,341	1,833
Agricultural	0	0	41	1,625	1,666
Residential	240	0	22	108	370
	21,961	6,229	35,643	57,900	121,733

*Percent ownership in general vegetation cover*

General Cover	Tribal	Trib Fee	Allotted	Alienated
Upland Deciduous	52	75	58	61
Upland Mixed	16	11	16	14
Nonforest Wetland	16	9	14	8
Lowland Deciduous	5	2	7	7
Upland Conifer	5	1	2	4
Lowland Conifer	4	0	1	1
Open	1	1	1	2
Agricultural	0	0	0	3
Residential	1	0	0	0
	100	100	100	100

Total Tribal
58
16
14
6
3
2
1
0
0
100

e.g., 58% of tribal lands  
are upland deciduous

*Percent of general vegetation cover under owner*

General Cover	Tribal	Trib Fee	Allotted	Alienated
Upland Deciduous	16	6	29	49
Upland Mixed	20	4	32	45
Nonforest Wetland	26	4	37	34
Lowland Deciduous	14	2	32	52
Upland Conifer	26	2	18	53
Lowland Conifer	49	1	26	25
Open	11	3	13	73
Agricultural	0	0	2	98
Residential	65	0	6	29

Total Tribal
51
55
66
48
47
75
27
2
71
100

e.g., 51% of upland deciduous  
forest is tribally owned

*Percent of the whole*

General Cover	Tribal	Trib Fee	Allotted	Alienated
Upland Deciduous	9	4	17	29
Upland Mixed	3	1	5	7
Nonforest Wetland	3	0	4	4
Lowland Deciduous	1	0	2	3
Upland Conifer	1	0	1	2
Lowland Conifer	1	0	0	0
Open	0	0	0	1
Agricultural	0	0	0	1
Residential	0	0	0	0

Total Tribal
30
8
7
3
1
1
0
0
0
0

e.g., of entire rez, 30% is  
tribally owned upland deciduous

## Landtypes vs. Land Ownership

*Landtype vs. land ownership (acres)*

Landtype	Tribal	Trib Fee	Allotted	Alienated	
Upland clay plain	9,610	4,450	18,219	34,538	66,817
Clayey ravines	3,388	1,116	4,719	8,423	17,646
Sloping sand over clay	3,563	429	5,489	7,991	17,472
Coastal wetland	4,060	43	3,860	1,924	9,887
Floodplain	1,172	47	2,770	3,896	7,885
Sandy uplands	439	253	666	1,425	2,784
	22,232	6,338	35,723	58,197	122,490

*Percent ownership in landtype*

Landtype	Tribal	Trib Fee	Allotted	Alienated
Upland clay plain	43	70	51	59
Clayey ravines	15	18	13	14
Sloping sand over clay	16	7	15	14
Coastal wetland	18	1	11	3
Floodplain	5	1	8	7
Sandy uplands	2	4	2	2
	100	100	100	100

Total Tribal
50
14
15
12
6
2
100

e.g., 50% of tribal lands  
are upland clay plain

*Percent of landtype under owner*

Landtype	Tribal	Trib Fee	Allotted	Alienated	
Upland clay plain	14	7	27	52	100
Clayey ravines	19	6	27	48	100
Sloping sand over clay	20	2	31	46	100
Coastal wetland	41	0	39	19	100
Floodplain	15	1	35	49	100
Sandy uplands	16	9	24	51	100

Total Tribal
48
52
54
81
51
49

e.g., 48% of the upland  
clay plain is tribally owned

*Percent of the whole*

Landtype	Tribal	Trib Fee	Allotted	Alienated
Upland clay plain	8	4	15	28
Clayey ravines	3	1	4	7
Sloping sand over clay	3	0	4	7
Coastal wetland	3	0	3	2
Floodplain	1	0	2	3
Sandy uplands	0	0	1	1

Total Tribal
26
8
8
7
3
1

e.g., of entire rez, 26% is  
tribally owned upland clay plain

100

## Resource Management Areas vs. Land Ownership

### Resource management areas vs. land ownership (acres)

Resource Management Areas	Tribal	Trib Fee	Allotted	Alienated
Conservation Areas	7,114	428	10,452	12,191
Watershed Protection Areas	4,652	1,600	6,150	10,858
Restoration Areas	2,494	877	3,834	7,483
Timber Production Areas	7,985	3,385	15,284	27,521
	22,245	6,290	35,720	58,053

30,185

23,260

14,688

54,175

122,308

### Percent ownership in resource management area

Resource Management Areas	Tribal	Trib Fee	Allotted	Alienated
Conservation Areas	32	7	29	21
Watershed Protection Areas	21	25	17	19
Restoration Areas	11	14	11	13
Timber Production Areas	36	54	43	47
	100	100	100	100

Total Tribal
28
19
11
41

e.g., 29% of tribal lands

are in conservation areas

100

### Percent of resource management area under ownership

Resource Management Areas	Tribal	Trib Fee	Allotted	Alienated
Conservation Areas	24	1	35	40
Watershed Protection Areas	20	7	26	47
Restoration Areas	17	6	26	51
Timber Production Areas	15	6	28	51

100

100

100

100

Total Tribal
60
53
49
49

e.g., 60% of conservation

areas are tribally owned

### Percent of the whole

Resource Management Areas	Tribal	Trib Fee	Allotted	Alienated
Conservation Areas	6	0	9	10
Watershed Protection Areas	4	1	5	9
Restoration Areas	2	1	3	6
Timber Production Areas	7	3	12	23

Total Tribal
15
10
6
22

e.g., of entire rez, 15% is

tribally owned conservation area

100

## Resource Management Areas vs. Vegetative Cover

*Vegetation cover vs. resource management areas (acres)*

Vegetation cover	Conservation Areas	Watershed Protection Areas	Restoration Areas	Timber Production Areas	
Aspen-Red Maple Forest	5,853	5,798	4,455	17,839	33,945
Boreal Hardwood-Conifer Forest	2,672	5,051	2,423	7,654	17,800
Aspen Clearcut	955	3,698	2,836	8,001	15,490
Aspen Forest	2,002	2,197	1,397	5,370	10,966
Northern Hardwood Forest	384	2,811	1,537	4,540	9,272
Alder Thicket	3,188	283	339	3,645	7,455
Sugar Maple-Basswood Forest	2,734	272	119	102	3,227
Northern Sedge Meadow	2,306	187	110	258	2,861
Mixed Hardwood Swamp	1,989	321	77	182	2,569
Open Water	1,471	177	117	262	2,027
Agricultural	196	112	175	1,183	1,666
Open Bog	1,653	0	0	0	1,653
Aspen-Birch Forest	273	440	277	617	1,607
Black Ash Swamp	1,094	272	80	159	1,605
Mixed Conifer Forest	468	494	136	428	1,526
Red Pine Forest	59	195	128	1,029	1,411
Tamarack Swamp	1,280	4	3	1	1,288
Willow Thicket	241	6	22	630	899
Oak Forest	0	276	191	404	871
Upland Brush	36	26	58	629	749
White Pine Forest	19	401	70	256	746
Upland Meadow	60	28	75	514	677
Silver Maple-Boxelder Forest	569	24	1	0	594
Aquatic	339	0	0	0	339
Spruce-Fir Forest	66	81	74	186	407
Residential	152	1	3	215	371
Pine-Birch-Oak Forest	261	0	0	0	261
Sand	259	0	0	0	259
Swamp Conifer Forest	109	3	4	42	158
Upland White Cedar Forest	50	77	4	0	131
Sandbar Meadow	74	26	0	0	100
	30,811	23,260	14,710	54,146	122,927

*Percent resource management area in vegetation cover*

Vegetative cover	Conservation Areas	Watershed Protection Areas	Restoration Areas	Timber Production Areas	
Aspen-Red Maple Forest	19	25	30	33	e.g., 19% of conservation areas are in aspen-red maple forest
Boreal Hardwood-Conifer Forest	9	22	16	14	
Aspen Clearcut	3	16	19	15	
Aspen Forest	6	9	9	10	
Northern Hardwood Forest	1	12	10	8	
Alder Thicket	10	1	2	7	
Sugar Maple-Basswood Forest	9	1	1	0	
Northern Sedge Meadow	7	1	1	0	
Mixed Hardwood Swamp	6	1	1	0	
Open Water	5	1	1	0	
Agricultural	1	0	1	2	
Open Bog	5	0	0	0	
Aspen-Birch Forest	1	2	2	1	
Black Ash Swamp	4	1	1	0	
Mixed Conifer Forest	2	2	1	1	
Red Pine Forest	0	1	1	2	
Tamarack Swamp	4	0	0	0	
Willow Thicket	1	0	0	1	
Oak Forest	0	1	1	1	
Upland Brush	0	0	0	1	
White Pine Forest	0	2	0	0	
Upland Meadow	0	0	1	1	
Silver Maple-Boxelder Forest	2	0	0	0	
Aquatic	1	0	0	0	
Spruce-Fir Forest	0	0	1	0	
Residential	0	0	0	0	
Pine-Birch-Oak Forest	1	0	0	0	
Sand	1	0	0	0	
Swamp Conifer Forest	0	0	0	0	
Upland White Cedar Forest	0	0	0	0	
Sandbar Meadow	0	0	0	0	
	100	100	100	100	

## Resource Management Areas vs. Vegetative Cover (cont.)

Percent vegetative cover in resource management area

Vegetation cover	Conservation Areas	Watershed Protection Areas	Restoration Areas	Timber Production Areas	
Aspen-Red Maple Forest	17	17	13	53	100
Boreal Hardwood-Conifer Forest	15	28	14	43	100
Aspen Clearcut	6	24	18	52	100
Aspen Forest	18	20	13	49	100
Northern Hardwood Forest	4	30	17	49	100
Alder Thicket	43	4	5	49	100
Sugar Maple-Basswood Forest	85	8	4	3	100
Northern Sedge Meadow	81	7	4	9	100
Mixed Hardwood Swamp	77	12	3	7	100
Open Water	73	9	6	13	100
Agricultural	12	7	10	71	100
Open Bog	100	0	0	0	100
Aspen-Birch Forest	17	27	17	38	100
Black Ash Swamp	68	17	5	10	100
Mixed Conifer Forest	31	32	9	28	100
Red Pine Forest	4	14	9	73	100
Tamarack Swamp	99	0	0	0	100
Willow Thicket	27	1	2	70	100
Oak Forest	0	32	22	46	100
Upland Brush	5	4	8	84	100
White Pine Forest	2	54	9	34	100
Upland Meadow	9	4	11	76	100
Silver Maple-Boxelder Forest	96	4	0	0	100
Aquatic	100	0	0	0	100
Spruce-Fir Forest	16	20	18	46	100
Residential	41	0	1	58	100
Pine-Birch-Oak Forest	100	0	0	0	100
Sand	100	0	0	0	100
Swamp Conifer Forest	69	2	3	26	100
Upland White Cedar Forest	38	59	3	0	100
Sandbar Meadow	74	26	0	0	100

e.g., 17% of aspen-red maple forest is in conservation areas

Percent of the whole

Vegetation cover	Conservation Areas	Watershed Protection Areas	Restoration Areas	Timber Production Areas
Aspen-Red Maple Forest	4.8	4.7	3.6	14.5
Boreal Hardwood-Conifer Forest	2.2	4.1	2.0	6.2
Aspen Clearcut	0.8	3.0	2.3	6.5
Aspen Forest	1.6	1.8	1.1	4.4
Northern Hardwood Forest	0.3	2.3	1.3	3.7
Alder Thicket	2.6	0.2	0.3	3.0
Sugar Maple-Basswood Forest	2.2	0.2	0.1	0.1
Northern Sedge Meadow	1.9	0.2	0.1	0.2
Mixed Hardwood Swamp	1.6	0.3	0.1	0.1
Open Water	1.2	0.1	0.1	0.2
Agricultural	0.2	0.1	0.1	1.0
Open Bog	1.3	0.0	0.0	0.0
Aspen-Birch Forest	0.2	0.4	0.2	0.5
Black Ash Swamp	0.9	0.2	0.1	0.1
Mixed Conifer Forest	0.4	0.4	0.1	0.3
Red Pine Forest	0.0	0.2	0.1	0.8
Tamarack Swamp	1.0	0.0	0.0	0.0
Willow Thicket	0.2	0.0	0.0	0.5
Oak Forest	0.0	0.2	0.2	0.3
Upland Brush	0.0	0.0	0.0	0.5
White Pine Forest	0.0	0.3	0.1	0.2
Upland Meadow	0.0	0.0	0.1	0.4
Silver Maple-Boxelder Forest	0.5	0.0	0.0	0.0
Aquatic	0.3	0.0	0.0	0.0
Spruce-Fir Forest	0.1	0.1	0.1	0.2
Residential	0.1	0.0	0.0	0.2
Pine-Birch-Oak Forest	0.2	0.0	0.0	0.0
Sand	0.2	0.0	0.0	0.0
Swamp Conifer Forest	0.1	0.0	0.0	0.0
Upland White Cedar Forest	0.0	0.1	0.0	0.0
Sandbar Meadow	0.1	0.0	0.0	0.0

e.g., of entire rez, 4.8% is conservation area in aspen-red maple forest

## Resource Management Areas vs. Generalized Vegetative Cover

Generalized vegetation cover vs. resource management areas (acres)

Generalized vegetation	Conservation Areas	Watershed Protection Areas	Restoration Areas	Timber Production Areas	acres
Upland Deciduous	9,466	15,219	10,691	36,771	72,147
Upland Mixed	2,933	5,051	2,423	7,654	18,061
Nonforest Wetland	7,726	475	471	4,532	13,204
Lowland Deciduous	6,386	889	277	443	7,995
Upland Conifer	596	1,168	338	1,714	3,816
Lowland Conifer	1,455	88	81	229	1,853
Open	778	186	306	2,539	3,809
	29,340	23,076	14,587	53,882	120,885

Percent of resource management area in general vegetation cover

Generalized vegetation	Conservation Areas	Watershed Protection Areas	Restoration Areas	Timber Production Areas
Upland Deciduous	32	66	73	68
Upland Mixed	10	22	17	14
Nonforest Wetland	26	2	3	8
Lowland Deciduous	22	4	2	1
Upland Conifer	2	5	2	3
Lowland Conifer	5	0	1	0
Open	3	1	2	5
	100	100	100	100

e.g., 32% of conservation areas  
are in upland deciduous

Percent of general vegetation cover in resource management area

Generalized vegetation	Conservation Areas	Watershed Protection Areas	Restoration Areas	Timber Production Areas
Upland Deciduous	13	21	15	51
Upland Mixed	16	28	13	42
Nonforest Wetland	59	4	4	34
Lowland Deciduous	80	11	3	6
Upland Conifer	16	31	9	45
Lowland Conifer	79	5	4	12
Open	20	5	8	67

100 e.g., 13% of upland deciduous  
100 forest is in conservation areas  
100  
100  
100  
100  
100  
100

Percent of the whole

Generalized vegetation	Conservation Areas	Watershed Protection Areas	Restoration Areas	Timber Production Areas
Upland Deciduous	7.8	12.6	8.8	30.4
Upland Mixed	2.4	4.2	2.0	6.3
Nonforest Wetland	6.4	0.4	0.4	3.7
Lowland Deciduous	5.3	0.7	0.2	0.4
Upland Conifer	0.5	1.0	0.3	1.4
Lowland Conifer	1.2	0.1	0.1	0.2
Open	0.6	0.2	0.3	2.1

e.g., of entire rez, 7.8% is conservation  
area in upland deciduous forest

100

## Resource Management Areas vs. Landtypes

*Landtype vs. resource management areas (acres)*

Landtype	Conservation Areas	Restoration Areas	Timber Production Areas	Watershed Protection Areas	
Upland clay plain	7,544	9,193	44,861	4,974	66,572
Clayey ravines	4,034	0	0	13,466	17,500
Sloping sand over clay	1,655	4,672	7,630	3,481	17,438
Coastal wetland	9,821	0	0	0	9,821
Floodplain	6,691	322	210	527	7,750
Sandy uplands	0	500	1,471	807	2,778
	29,745	14,687	54,172	23,255	121,859

*Percent of resource management area in landtype*

Landtype	Conservation Areas	Restoration Areas	Timber Production Areas	Watershed Protection Areas
Upland clay plain	25	63	83	21
Clayey ravines	14	0	0	58
Sloping sand over clay	6	32	14	15
Coastal wetland	33	0	0	0
Floodplain	22	2	0	2
Sandy uplands	0	3	3	3
	100	100	100	100

e.g., 25% of conservation areas  
are in upland clay plain

*Percent of landtype in resource management area*

Landtype	Conservation Areas	Restoration Areas	Timber Production Areas	Watershed Protection Areas
Upland clay plain	11	14	67	7
Clayey ravines	23	0	0	77
Sloping sand over clay	9	27	44	20
Coastal wetland	100	0	0	0
Floodplain	86	4	3	7
Sandy uplands	0	18	53	29
	100	100	100	100

e.g., 11% of upland clay plain  
are in conservation areas

*Percent of the whole*

Landtype	Conservation Areas	Restoration Areas	Timber Production Areas	Watershed Protection Areas
Upland clay plain	6.2	7.5	36.8	4.1
Clayey ravines	3.3	0.0	0.0	11.1
Sloping sand over clay	1.4	3.8	6.3	2.9
Coastal wetland	8.1	0.0	0.0	0.0
Floodplain	5.5	0.3	0.2	0.4
Sandy uplands	0.0	0.4	1.2	0.7

e.g., of entire rez, 6.2% is  
conservation area in upland  
clay plain

100

## Landtypes vs. Vegetative Cover

Vegetation Cover vs. landtype (acres)

Vegetation Cover	Upland clay plain	Clayey ravines	Sloping sand over clay	Coastal wetland	Floodplain	Sandy uplands	
Aspen-Red Maple Forest	23,713	4,577	4,669	265	754	22	34,002
Boreal Hardwood-Conifer Forest	11,534	4,426	1,295	92	488	0	17,835
Aspen Clearcut	10,214	2,405	2,592	0	143	180	15,534
Aspen Forest	6,354	1,740	2,391	52	436	0	10,972
Northern Hardwood Forest	1,419	1,274	4,761	0	188	1,641	9,282
Alder Thicket	4,927	173	116	2,132	120	2	7,470
Sugar Maple-Basswood Forest	133	400	246	0	2,386	0	3,165
Northern Sedge Meadow	543	105	4	2,157	74	0	2,884
Mixed Hardwood Swamp	650	362	10	513	1,013	0	2,548
Agricultural	1,331	77	253	0	4	0	1,666
Open Bog	43	0	0	1,609	0	0	1,652
Black Ash Swamp	160	246	2	11	1,190	0	1,609
Aspen-Birch Forest	527	431	604	0	42	3	1,607
Mixed Conifer Forest	561	505	197	202	62	0	1,528
Red Pine Forest	1,118	119	67	0	7	101	1,412
Tamarack Swamp	4	2	0	1,257	25	0	1,288
Open Water	528	154	52	206	230	12	1,182
Willow Thicket	695	0	11	158	35	0	899
Oak Forest	50	0	12	0	0	809	870
Upland Brush	738	12	0	0	0	0	750
White Pine Forest	338	328	76	0	4	0	746
Upland Meadow	634	14	19	0	7	2	676
Silver Maple-Boxelder Forest	6	42	6	0	521	0	576
Spruce-Fir Forest	244	75	73	0	15	0	407
Residential	286	0	0	66	4	10	367
Aquatic	3	0	0	319	0	0	322
Pine-Birch-Oak Forest	0	0	0	261	0	0	261
Sand	0	0	0	236	0	0	236
Swamp Conifer Forest	48	17	4	0	88	0	157
Upland White Cedar Forest	11	98	3	0	18	0	129
Sandbar Meadow	2	66	3	0	28	0	98
	66,814	17,644	17,467	9,537	7,883	2,784	122,129

Percent landtype in vegetation cover

Vegetation Cover	Upland clay plain	Clayey ravines	Sloping sand over clay	Coastal wetland	Floodplain	Sandy uplands	
Aspen-Red Maple Forest	35	26	27	3	10	1	e.g., 35% of upland clay
Boreal Hardwood-Conifer Forest	17	25	7	1	6	0	plain is in aspen-red
Aspen Clearcut	15	14	15	0	2	6	maple forest
Aspen Forest	10	10	14	1	6	0	
Northern Hardwood Forest	2	7	27	0	2	59	
Alder Thicket	7	1	1	22	2	0	
Sugar Maple-Basswood Forest	0	2	1	0	30	0	
Northern Sedge Meadow	1	1	0	23	1	0	
Mixed Hardwood Swamp	1	2	0	5	13	0	
Agricultural	2	0	1	0	0	0	
Open Bog	0	0	0	17	0	0	
Black Ash Swamp	0	1	0	0	15	0	
Aspen-Birch Forest	1	2	3	0	1	0	
Mixed Conifer Forest	1	3	1	2	1	0	
Red Pine Forest	2	1	0	0	0	4	
Tamarack Swamp	0	0	0	13	0	0	
Open Water	1	1	0	2	3	0	
Willow Thicket	1	0	0	2	0	0	
Oak Forest	0	0	0	0	0	29	
Upland Brush	1	0	0	0	0	0	
White Pine Forest	1	2	0	0	0	0	
Upland Meadow	1	0	0	0	0	0	
Silver Maple-Boxelder Forest	0	0	0	0	7	0	
Spruce-Fir Forest	0	0	0	0	0	0	
Residential	0	0	0	1	0	0	
Aquatic	0	0	0	3	0	0	
Pine-Birch-Oak Forest	0	0	0	3	0	0	
Sand	0	0	0	2	0	0	
Swamp Conifer Forest	0	0	0	0	1	0	
Upland White Cedar Forest	0	1	0	0	0	0	
Sandbar Meadow	0	0	0	0	0	0	
	100	100	100	100	100	100	

## Landtypes vs. Vegetative Cover (cont.)

Vegetation Cover	Upland clay plain	Clayey ravines	Sloping sand over clay	Coastal wetland	Floodplain	Sandy uplands
Aspen-Red Maple Forest	70	13	14	1	2	0
Boreal Hardwood-Conifer Forest	65	25	7	1	3	0
Aspen Clearcut	66	15	17	0	1	1
Aspen Forest	58	16	22	0	4	0
Northern Hardwood Forest	15	14	51	0	2	18
Alder Thicket	66	2	2	29	2	0
Sugar Maple-Basswood Forest	4	13	8	0	75	0
Northern Sedge Meadow	19	4	0	75	3	0
Mixed Hardwood Swamp	25	14	0	20	40	0
Agricultural	80	5	15	0	0	0
Open Bog	3	0	0	97	0	0
Black Ash Swamp	10	15	0	1	74	0
Aspen-Birch Forest	33	27	38	0	3	0
Mixed Conifer Forest	37	33	13	13	4	0
Red Pine Forest	79	8	5	0	1	7
Tamarack Swamp	0	0	0	98	2	0
Open Water	45	13	4	17	19	1
Willow Thicket	77	0	1	18	4	0
Oak Forest	6	0	1	0	0	93
Upland Brush	98	2	0	0	0	0
White Pine Forest	45	44	10	0	1	0
Upland Meadow	94	2	3	0	1	0
Silver Maple-Boxelder Forest	1	7	1	0	91	0
Spruce-Fir Forest	60	18	18	0	4	0
Residential	78	0	0	18	1	3
Aquatic	1	0	0	99	0	0
Pine-Birch-Oak Forest	0	0	0	100	0	0
Sand	0	0	0	100	0	0
Swamp Conifer Forest	31	11	2	0	56	0
Upland White Cedar Forest	9	76	2	0	14	0
Sandbar Meadow	2	67	3	0	29	0

100 e.g., 70% of aspen-red  
100 maple forest is in upland  
100 clay plain  
100

Percent of the whole

Vegetation Cover	Upland clay plain	Clayey ravines	Sloping sand over clay	Coastal wetland	Floodplain	Sandy uplands
Aspen-Red Maple Forest	19.4	3.7	3.8	0.2	0.6	0.0
Boreal Hardwood-Conifer Forest	9.4	3.6	1.1	0.1	0.4	0.0
Aspen Clearcut	8.4	2.0	2.1	0.0	0.1	0.1
Aspen Forest	5.2	1.4	2.0	0.0	0.4	0.0
Northern Hardwood Forest	1.2	1.0	3.9	0.0	0.2	1.3
Alder Thicket	4.0	0.1	0.1	1.7	0.1	0.0
Sugar Maple-Basswood Forest	0.1	0.3	0.2	0.0	2.0	0.0
Northern Sedge Meadow	0.4	0.1	0.0	1.8	0.1	0.0
Mixed Hardwood Swamp	0.5	0.3	0.0	0.4	0.8	0.0
Agricultural	1.1	0.1	0.2	0.0	0.0	0.0
Open Bog	0.0	0.0	0.0	1.3	0.0	0.0
Black Ash Swamp	0.1	0.2	0.0	0.0	1.0	0.0
Aspen-Birch Forest	0.4	0.4	0.5	0.0	0.0	0.0
Mixed Conifer Forest	0.5	0.4	0.2	0.2	0.1	0.0
Red Pine Forest	0.9	0.1	0.1	0.0	0.0	0.1
Tamarack Swamp	0.0	0.0	0.0	1.0	0.0	0.0
Open Water	0.4	0.1	0.0	0.2	0.2	0.0
Willow Thicket	0.6	0.0	0.0	0.1	0.0	0.0
Oak Forest	0.0	0.0	0.0	0.0	0.0	0.7
Upland Brush	0.6	0.0	0.0	0.0	0.0	0.0
White Pine Forest	0.3	0.3	0.1	0.0	0.0	0.0
Upland Meadow	0.5	0.0	0.0	0.0	0.0	0.0
Silver Maple-Boxelder Forest	0.0	0.0	0.0	0.0	0.4	0.0
Spruce-Fir Forest	0.2	0.1	0.1	0.0	0.0	0.0
Residential	0.2	0.0	0.0	0.1	0.0	0.0
Aquatic	0.0	0.0	0.0	0.3	0.0	0.0
Pine-Birch-Oak Forest	0.0	0.0	0.0	0.2	0.0	0.0
Sand	0.0	0.0	0.0	0.2	0.0	0.0
Swamp Conifer Forest	0.0	0.0	0.0	0.0	0.1	0.0
Upland White Cedar Forest	0.0	0.1	0.0	0.0	0.0	0.0
Sandbar Meadow	0.0	0.1	0.0	0.0	0.0	0.0

e.g., of entire rez,  
19.4% is aspen-red  
maple forest in upland clay plain

## Landtypes vs. Generalized Vegetative Cover

Landtype vs. generalized vegetation cover (acres)

Generalized Cover	Upland clay plain	Clayey ravines	Sloping sand over clay	Coastal wetland	Floodplain	Sandy uplands
	42277	10426	15028	318	1562	2656
Upland Mixed	11534	4426	1295	353	488	0
Nonforest Wetland	6211	278	132	6374	229	2
Lowland Deciduous	949	1050	264	525	5110	0
Upland Conifer	2028	1049	343	202	91	101
Lowland Conifer	296	94	76	1257	128	0
Open	1374	91	22	236	35	2
Agricultural	1331	77	253	0	4	0
Residential	286	0	0	66	4	10
	66286	17490	17415	9331	7653	2773

72267

18096

13227

7898

3815

1852

1761

1666

367

120948

Percent of land type in generalized vegetation cover

Generalized Cover	Upland clay plain	Clayey ravines	Sloping sand over clay	Coastal wetland	Floodplain	Sandy uplands
Upland Deciduous	64	60	86	3	20	96
Upland Mixed	17	25	7	4	6	0
Nonforest Wetland	9	2	1	68	3	0
Lowland Deciduous	1	6	2	6	67	0
Upland Conifer	3	6	2	2	1	4
Lowland Conifer	0	1	0	13	2	0
Open	2	1	0	3	0	0
Agricultural	2	0	1	0	0	0
Residential	0	0	0	1	0	0
	100	100	100	100	100	100

e.g., 64% of upland clay plain  
is in upland deciduous forest

Percent of generalized vegetation cover in land type

Generalized Cover	Upland clay plain	Clayey ravines	Sloping sand over clay	Coastal wetland	Floodplain	Sandy uplands
Upland Deciduous	59	14	21	0	2	4
Upland Mixed	64	24	7	2	3	0
Nonforest Wetland	47	2	1	48	2	0
Lowland Deciduous	12	13	3	7	65	0
Upland Conifer	53	27	9	5	2	3
Lowland Conifer	16	5	4	68	7	0
Open	78	5	1	13	2	0
Agricultural	80	5	15	0	0	0
Residential	78	0	0	18	1	3
	100	100	100	100	100	100

100

100

100

100

100

100

100

100

100

100

e.g., 59% of upland deciduous  
forest is in upland clay plain

Percent of the whole

Generalized Cover	Upland clay plain	Clayey ravines	Sloping sand over clay	Coastal wetland	Floodplain	Sandy uplands
Upland Deciduous	35.0	8.6	12.4	0.3	1.3	2.2
Upland Mixed	9.5	3.7	1.1	0.3	0.4	0.0
Nonforest Wetland	5.1	0.2	0.1	5.3	0.2	0.0
Lowland Deciduous	0.8	0.9	0.2	0.4	4.2	0.0
Upland Conifer	1.7	0.9	0.3	0.2	0.1	0.1
Lowland Conifer	0.2	0.1	0.1	1.0	0.1	0.0
Open	1.1	0.1	0.0	0.2	0.0	0.0
Agricultural	1.1	0.1	0.2	0.0	0.0	0.0
Residential	0.2	0.0	0.0	0.1	0.0	0.0

e.g., of entire rez, 35% is upland  
deciduous in upland clay plain

100

**APPENDIX D. THE HISTORY OF FORESTRY ON THE**  
**BAD RIVER RESERVATION**

The following brief description of the history of timber resources, harvest, and management on the Reservation is adapted from the document by Godfrey (1996) called, "A Forestry History of Ten Wisconsin Indian Reservations Under the Great Lakes Agency: Precontact to the Present".

#### History of Timber Resources on the Bad River Reservation

Prior to the 1840s, the Bad River Reservation was a heavily forested area. Tribal members used the forests for hunting and gathering, and logging by non-Indian settlers had not yet begun on the Reservation. The growth of the regional mining industry, which began in 1842 after the signing of the Copper Treaty or Miners Treaty, changed the face of Northern Wisconsin forests forever. The large demand for timber to construct mines and housing for newcomers motivated the Bad River Band members to begin logging.

In addition to logging, the push by the U.S. federal government for tribal members to become farmers (1840s-1870s) hastened the changing face of the Reservation landscape. In order to farm, tribal members first had to clear their land of timber. While a few small farms existed on the Bad River Reservation in the 1870s, the largest crop at this time came from the forest in the form of maple syrup and sugar. Tribal members produced several hundred gallons of syrup in 1874 and 40 tons of maple sugar in 1875.

The pine logging boom began in earnest in the 1870s. In the 20 years between 1870-1890 approximately half the pine on the Bad River Reservation was cut. Many tribal members worked for lumber companies at this time. This was also the time when the federal government began to divide tribal land into allotments. Bad River allottees cut approximately 27 million board feet of pine off their lands in the early to mid-1880s. Prior to 1886-1887, logging on the Bad River Reservation was limited to tribal members; non-members were not allowed to cut or deliver Reservation timber. This rule was changed before the 1886-1887 harvest season, and due to increased employment the annual harvest of pine nearly doubled for the next few years.

Huge log drives occurred on the Bad River and its tributaries in the 1880s, as much of the virgin pine was cut. In the 1890s, railroad lines were built to link the heavily forested Bad River area to cities farther south. This railroad connection facilitated the

harvest of hardwoods. The era of hardwoods logging dominated the timber industry on the Reservation until the late 1930s.

In the 1890s and early 1900s, several severe and extensive fires burned various parts of the Reservation. It was during this time that J.S. Stearns had the contract to purchase timber on the Bad River Reservation. In addition to buying red and white pine, white cedar, American elm, and basswood, Stearns also purchased dead and down and burned timber (Table D1). In 1908-1909, Stearns logged an extraordinary 50 million board feet due primarily to the availability of dead and down timber. Stearns established a timber mill on the Reservation in 1909, with an Indian preference in hiring, in exchange for a monopoly on tribal and allotted lands timber harvesting.

The Office of Indian Affairs (hereafter referred to by its current name, Bureau of Indian Affairs, or BIA), formed a Forestry Branch in 1909-1910, and began to gather data on the conditions and value of the remaining timber and formulate a plan to protect tribal timber from fire, disease, and pests. Prior to this time, the BIA seemed to have no regard for conserving timber resources, its primary goal being to provide employment for tribal members in the timber industry.

In 1922, the Stearns mill closed, leaving most tribal members unemployed and impoverished. Even though much of the Reservation was badly cut-over and burned, resulting in damaged soil, the BIA once again encouraged tribal members to become farmers. All remaining forested tribal lands were divided into allotments, and all allotments on clay soil were clearcut for farming. Many tribal members did not have enough money to clear the stumps from their allotment for agriculture and were forced to sell their land. The selling of allotments caused the checkerboard pattern of land ownership on the Reservation that still exists today.

By 1932, the commercial harvest of all virgin timber of value was completed and the second growth, mostly pulp (aspen, balsam, and white spruce) began.

In 1933-1934, the BIA used Civil Work Administration funds to make jobs for tribal members conducting a timber survey on the Reservation. The 1600 acres surveyed contained a good understory of red and white pine, balsam, and white spruce on the west side of the Reservation, and good young white pine on well-drained areas and

Table D1. Bad River Reservation Timber Statistics 1893-1908. Tribal timber cut (million board feet) under contract, based on Commissioner of Indian Affairs Annual Reports by calendar year and related historical resources (Godfrey 1996).

Season	White Pine	Red Pine	Hemlock	White Cedar	Elm	Basswood	Dead/Down
1893-1894	1,072,580	644,790	123,880	213,560	2,590	6,860	99,650
1894-1895	4,959,040	3,392,710	103,300	1,007,230	40,620	6,150	433,290
1895-1896	4,883,970	3,011,460	36,510	2,195,160	39,000	14,980	3,718,130
1896-1897	9,166,500	1,990,990	3,610	1,137,970	320	2,330	6,759,600
1897-1898	12,308,060	3,483,840	55,270	1,705,920	22,780	4,660	12,058,080
1898-1899	12,923,320	12,923,320	34,660	2,545,330	4,000	2,360	5,773,360
1899-1900	17,645,540	8,567,850	155,860	927,620	317,980	61,390	405,470
1900-1901	22,536,870	10,637,540	80,020	768,670	127,250	3,710	267,440
1901-1902	26,102,760	10,244,080	100,210	610,000	7,760	1,830	148,380
1902-1903	21,229,780	10,755,470	2,299,820	353,230	84,640	29,030	776,320
1903-1904	35,770,620	13,917,260	6,517,900	861,300	613,250	109,860	734,780
1904-1905	33,832,640	17,713,130	1,091,900	323,180	517,680	22,790	109,550
1905-1906	35,986,400	6,142,520	1,228,650	151,070	212,370	67,810	201,735
1906-1907	46,301,266	8,073,180	432,535		115,270	49,120	78,230
1907-1908	114,493,930	33,876,067	2,812,155		85,690	107,400	97,815

white spruce and balsam on poorly-drained areas of the east side of the Reservation.

The survey also showed that mature hardwoods still existed in the river bottomlands, hemlock and yellow birch dominated tribal lands on Madeline Island, and many large deadhead logs were stuck in the rivers. The Bad River Band began to salvage these deadhead logs from the Bad and White Rivers in the mid-1930s. Using funds from the Works Progress Administration the Band set up a mill in Odanah to make lumber to sell and for the repair of the town.

In the early to mid-1930s, the BIA suggested cutting timber on a sustained annual yield basis. This represented a change in philosophy, from maximizing profits for allottees, to a consideration for the sustainability of the resource. The BIA hired Band members to do Civilian Conservation Corps (CCC) projects between 1933 and 1943, such as construction of a fire tower, timber stand improvements, reforestation, timber surveys, firefighting, and white pine blister rust control work.

By the end of the CCC era the BIA still did not have accurate timber survey information to determine an appropriate annual allowable cut. In many areas soils were still too damaged by fires to be productive. In 1944 the BIA conducted an assessment of Bad River Reservation forests and determined that more land within Reservation boundaries must be acquired by the Band in order to conduct a forestry program, and that timber cutting would be limited to pulp and box bolts until the mid-1950s (because no large saw timber existed on the Reservation).

The outbreak of World War II created a high demand and a high price for timber. The demand was so high that the BIA could not keep up with timber permits and contracts. The Bad River Tribal Council formally complained to Washington, asking that timber contracts be granted more quickly to relieve unemployment. In 1948 the Tribal Council constructed roads into remote areas of the Reservation in order to harvest mature aspen. During the remainder of the 1950s loggers cut predominantly aspen and balsam under BIA forestry regulations.

The BIA completed the first Continuous Forest Inventory (a method of measuring growth and volume of timber on permanent sites) on the Reservation in 1962-1963. In 1964 the BIA completed a forest management plan for the Reservation, followed by a 10 year goal plan that included a higher annual allowable cut with financial incentives

that would benefit tribal members, a tree-planting program, a timber stand improvement program, and a resurvey of section lines and quarter corners.

As the timber resources recovered from the cut-over and fires (1930s - 1960s) the BIA made decisions with little input from the Tribal Council. The U.S. trust responsibilities for Indian forest lands during this time were to manage the land as commercial and industrial forests, which included timber inventory and growth studies, management plans, timber sales, and protection from fire, insects, and disease. Aspen dominated approximately 60% of Bad River forests at this time. The BIA recommended clearcutting the majority of aspen forests with the hope that the hardwood and pine understory would take over. Clearcutting at this time meant cutting all trees with at least three sticks of merchantable height (a stick is eight feet).

In 1973, the BIA made a change in aspen management rules that greatly increased the harvest of aspen: from harvesting aspen when three sticks or more of merchantable height existed, to harvesting aspen of only one merchantable stick. This change in harvest promoted aspen regeneration over that of other species.

The BIA began salvage operations for American elm stricken by Dutch elm disease in the early 1970s. In 1976, with the Band approving the harvest of infected elm and associated species, loggers removed 65 million board feet of elm from the river bottomlands.

In 1975 Congress passed the Indian Self-Determination and Education Assistance Act (P.L.93-638), which allowed tribes to contract management of their timber resources. Prior to passage of this act the BIA received approval for timber cuts from the Tribal Chair, but the Chair and Council were not involved in forest management and planning decisions. After passage of P.L.93-638 the Tribal Council began to plan the management of forest resources.

Bad River Band officials first began to question the authority and trust responsibility of the BIA in 1967, and began objecting to clearcutting in 1978. The Band established a Tribal Forestry Department in 1982. In 1985, the BIA contracted with an independent consultant forester to complete a stand exam of trust forest land and the Soil Conservation Service conducted a soil survey of the Bad River Reservation.

This concludes the summary of the history of timber resources and harvest on the Bad River Reservation, adapted from Godfrey (1996). The relationship between the Band and BIA foresters continues to change as Bad River Members become more interested in conservation and restoration of timber resources than in timber harvest. These conservation and restoration ideals are reflected in the designation of Resource Management Areas, and in the goals and objectives for timber resources, described earlier in this document

**APPENDIX E. ADDITIONAL INFORMATION ON THE FISH RESOURCES**  
**OF THE BAD RIVER RESERVATION**

- E1. Bad River Tribal Hatchery Production, 1986 - 1997**
- E2. The History of Lamprey on the Bad River Reservation**
- E3. River Ruffe Surveillance Summary Data, 1992 – 1997**

## Appendix E1. Bad River Tribal Hatchery Production, 1986-1997.

Year	Egg Source	Species	Lifestage	Number Stocked	Location Stocked
1986	?	walleye	fingerling	5,000	Kakagon Slough
1987	?	walleye	fry	3,300,000	Kakagon Slough
1988	LDF	walleye	fry	3,000,000	Kakagon Slough
	LDF	walleye	fingerling	10,900	Kakagon Slough
	LDF	walleye	fry	4,300,000	Bad River
	LDF	walleye	fingerling	7,500	Bad River
	BRTFH	lake sturgeon	fingerling	2,500	Bad River
1989	BRTFH	walleye	fry	4,000,000	Kakagon Slough
	BRTFH	walleye	fingerling	1,700	Kakagon Slough
	BRTFH	walleye	fry	4,920,000	Bad River
	BRTFH	walleye	fingerling	2,500	Bad River
	USFWS	brook trout	fingerling	500	Potato River
1990	BRTFH	walleye	fry	1,500,000	Kakagon Slough
	BRTFH	walleye	fingerling	10,000	Kakagon Slough
	USFWS	walleye	fry	1,000,000	Kakagon Slough
	BRTFH	walleye	fry	3,000,000	Bad River
	USFWS	walleye	fry	1,000,000	Bad River
1991	BRTFH	walleye	fry	4,500,000	Kakagon Slough
	BRTFH	walleye	fingerling	2,700	Kakagon Slough
	USFWS	walleye	fry	1,000,000	Kakagon Slough
	BRTFH	walleye	fry	5,000,000	Bad River
	BRTFH	walleye	fingerling	2,200	Bad River
	USFWS	walleye	fry	2,000,000	Bad River
1992	BRTFH	walleye	fry	7,000,000	Kakagon Slough
	BRTFH	walleye	fry	9,780,000	Bad River
	BRTFH	walleye	fingerling	8,000	Bad River
	USFWS	brook trout	fingerling	3,700	Potato River
1993	BRTFH	walleye	fry	8,000,000	Kakagon Slough
	BRTFH	walleye	fry	4,720,000	Bad River
	BRTFH	walleye	eggs	600,000*	Returned by WDNR*
1994	BRTFH	walleye	fry	9,648,000	Kakagon Slough
	BRTFH	walleye	fry	2,000,000	Bad River
1995	BRTFH	walleye	fry	7,740,000	Kakagon Slough
	BRTFH	walleye	fingerling	9,600	Kakagon Slough
	BRTFH	walleye	fry	1,920,000	Bad River
	BRTFH	walleye	fingerling	20,000	Bad River
	BRTFH	walleye	eggs	300,000*	Returned by WDNR*
1996	Bad River	walleye	fry	7,249,800	Kakagon Slough
	Bad River	walleye	fry	1,660,000	Bad River
1997	Bad River	walleye	fry	7,060,000	Kakagon Slough
	Bad River	walleye	fry	720,000	Bad River

LDF = Lac du Flambeau

BRTFH = Bad River Tribal Fish Hatchery

USFWS = U.S. Fish and Wildlife Service

WDNR = Wisconsin Department of Natural Resources

\* The WDNR received an unknown number of eggs from the BRTFH for stocking in Chequamegon Bay, and the Bad and Kakagon Rivers. The number reported in the "Number Stocked" column is the number returned to BRTFH.

## **Appendix E2. The History of Lamprey on the Bad River Reservation**

The following section provides a detailed summary of lamprey surveys and control history on the Reservation, an assessment of lampricide on organisms other than lamprey, the potential for reduction of lampricide use, and alternatives to lampricide use.

*Lamprey Assessment.* Sea lamprey assessment activities in the Bad River system began in 1952 when U.S. Fish and Wildlife Service (USFWS) crews identified the system as having a high potential to produce sea lamprey. The USFWS verified the presence of sea lamprey in the Bad River system in 1955.

The USFWS, Marquette Biological Station continues to conduct sea lamprey assessment activities in the Bad River, with assistance from the Great Lakes Indian Fish and Wildlife Commission (GLIFWC) and the Bad River Natural Resources Department (BRNRD). These assessment activities include surveys to determine larval abundance, document larval distribution and prepare for lampricide treatments, assess the success of the previous treatment, monitor re-established populations of larval sea lamprey, and search for new infestations of larvae. Larval population estimates provide information on sea lamprey production, growth and survival of larvae, treatment effectiveness, and habitat characteristics of sea lamprey-producing streams.

In addition to larval surveys, traps to capture spawning-phase sea lamprey, and fyke and hoop nets to capture transformers (larval sea lamprey undergoing metamorphosis into the parasitic adult phase) migrating out to Lake Superior, have been used by the USFWS to assess sea lamprey populations.

The population of larval sea lamprey inhabiting the Bad River system (the main stem of the Bad River and the main tributaries, including the White, Marengo, Brunsweller, and Potato Rivers) was estimated by GLIFWC, BRNRD, and USFWS personnel in 1991, prior to lampricide treatment, and again in 1992, after TFM treatment. A sharp reduction in the larval sea lamprey population occurred after TFM treatment (from 951,735 prior to treatment to 38,056 after treatment; Schleen et al. 1996).

In 1977, the USFWS placed an experimental mechanical trap on the White River as part of a program to assess spawning-phase sea lamprey populations. No sea lamprey were captured in the trap and the operation was discontinued. In 1985 the USFWS set typical assessment traps in the White River to capture spawning-phase sea lamprey for general biological information such as average length and weight and sex ratios.

The USFWS has been estimating the number of spawning-phase sea lamprey in the Bad River since 1986. The Bad River spawning-phase sea lamprey population estimate is important because this river is one of the most productive rivers in the Lake Superior basin and because it is one of the rivers used to calculate the total number of spawning sea lamprey in Lake Superior. Assessment traps are set at the lower falls of the Bad River, and are checked and maintained by GLIFWC personnel working collaboratively with the USFWS. Spawning-phase sea lamprey captured in the traps are marked and transported downstream for release. Some of these are later recaptured in the traps as they migrate back upstream. The number of lamprey captured, marked, and recaptured are used to determine the total number in the river.

The estimate of spawning-phase lamprey in Lake Superior (approximately 45,000) is based on a statistically significant relation between the number of lamprey that enter a river and mean stream discharge. The average number of spawning-phase lamprey in U.S. waters for the ten year period from 1987-96 was 30,566 (Table E2a). During this same time period the Bad River average was 4,480 spawning-phase lamprey.

*Lamprey Control History.* Sea lamprey control activities in the Bad River system began in 1956, when USFWS crews installed electrical barriers on the Bad and White Rivers. The electric barriers were in operation through the 1960 season. These efforts proved ineffective because during high water periods the barriers were easily negotiated by sea lamprey or were not operational due to damage from debris and the high water.

Chemical control of lamprey was initiated by the USFWS in Lake Superior in 1958. In 1962, after the first round of treatments in Lake Superior was completed, the lamprey population was reduced by 84%.

Table E2a. Bad River sea lamprey trap catch and estimated spawning population in the Bad River and in U.S. waters of Lake Superior from 1986-96. Data from USFWS, Marquette Biological Station.

Year	<u>BAD RIVER</u>		<u>LAKE SUPERIOR (US waters)</u>		
	Total Catch	Population Estimate	Population Estimate	W of Keweenaw	E of Keweenaw
1997	269	4442	29,234	21,147	8087
1996	313	8023	35707	29640	6067
1995	237	1951	24081	13649	10432
1994	110	2133	13688	11199	2489
1993	84	2428	24329	17491	6838
1992	236	2651	28538	357	8181
1991	121	3806	27545	20927	6618
1990	465	2665	30704	23604	7100
1989	684	9268	55032	47458	7574
1988	972	7128	42870	36611	6259
1987	439	4797	23166	Not separated west/east	
1986	184		60517	Not separated west/east	

In 1960, the USFWS treated the Bad River system with TFM for the first time. Since then portions of this river system have been treated by the USFWS, Marquette Biological Station on 15 occasions. A review of sea lamprey control activities and a biological inventory of non-target species (species other than lamprey killed by TFM) collected during these activities can be found in a USFWS document titled, Background Information on Sea Lamprey Control in the Bad River (October 13, 1994), and in an Appendix to that document (May 5, 1997), both of which are available at BRNRD.

*Assessment of Lampricide Use on Other Organisms.* Mortality of non-target organisms (species other than sea lamprey) during lampricide treatments has been a concern of fish managers since the implementation of the control program. The USFWS and other agencies have conducted studies to determine short-term and

long-term effects of TFM applications to fish and aquatic insects. Results of these studies have shown that TFM is a selective toxicant (i.e., TFM is relatively specific to sea lamprey) and when used according to label specifications, is acutely toxic to sea lamprey. Some non-target organisms (for example, burrowing mayfly and tadpole madtom) are highly sensitive to TFM at a concentration similar to that which is used for sea lamprey control. Therefore the sea lamprey control offices take precautions to reduce or avoid stress to these species. TFM does not bioaccumulate, it is broken down and degraded by sunlight within a few days. Complete results of the USFWS studies are in their document titled, Background Information on Sea Lamprey Control in the Bad River (October 13, 1994), and in an Appendix (May 5, 1997), both of which are available at BRNRD.

During treatment of the Bad River in September 1995, sensitivity of sea lamprey larvae and three non-target species to TFM was examined by the USFWS through toxicity tests. The tests were conducted with green frog tadpoles (*Rana clamitans*), freshwater mussels (*Eliptio complanata*), dragonfly nymphs (*Stylurus amicola*), and sea lamprey larvae on the White River. All three non-target species were found to be less sensitive to TFM than sea lamprey larvae. At concentrations of TFM used to kill sea lamprey larvae (approximately 2.7 mg/l) in the Bad and White Rivers, no mortality of non-target organisms occurred. Complete results of these toxicity tests are published in an Appendix (May 5, 1997) to the USFWS document, Background Information on Sea Lamprey Control in the Bad River (October 13, 1994), which is available at BRNRD.

In 1996, a team of investigators from the U.S. Geological Survey (USGS), USFWS, and BRNRD evaluated the effects of TFM treatments on adults and juveniles of two freshwater mussel taxa in the White River. The findings suggest that these mussels were more tolerant to TFM than sea lamprey were at concentrations equal to the LC99.9 (the concentration which kills 99.9% of individuals) for sea lamprey. In 1997, this research group continued evaluation of lampricide treatments by measuring effects of a combination of TFM and Bayer 73 (1% Bayluscide, another lampricide) on freshwater mussels in a twelve hour exposure. This combination of lampricides is more lethal to sea lamprey than is TFM alone. No mortality of mussels occurred at the LC99.9 for sea lamprey larvae. In 1998, growth and mortality of mussels were evaluated, though the results were not available at the time of this writing.

In addition to lampricide toxicity tests, the USFWS collected samples of two fish species, walleye and white sucker, and core samples of river sediment to analyze for dioxin-like impurities that were recently discovered in TFM. Contaminant analyses were conducted by the Department of Fisheries and Oceans (DFO) laboratory in Burlington, Canada. While dioxin-like impurities were found in the TFM formulations, no dioxins or dioxin-like impurities were found in fish or sediment samples. Complete results are summarized in the USFWS report, TFM Formulation Related Contaminants in Fish and Sediments From the Bad River (February 16, 1998), which is available at BRNRD.

*Current Lamprey Management Strategies.* The Great Lakes Fishery Commission and its contracted Sea Lamprey Control Agents (USFWS and DFO) currently control sea lamprey populations through an integrated management approach involving TFM, release of sterilized male lampreys, barriers, and trapping of spawning-phase lampreys. Sea lamprey populations in the Great Lakes have been reduced by approximately 90% of pre-treatment levels, and the fish populations are rebounding. Despite this success, however, continuous control of sea lamprey is required because enough lamprey remain after treatments to cause high mortality of fish in Lake Superior.

Mortality of desirable fish species (primarily lake trout and lake whitefish) caused by sea lamprey impacts cultural and economic opportunities of the Bad River Band. Sea lamprey control in the Bad River provides a direct benefit to Bad River members and other user groups who currently fish Lake Superior for commercial or subsistence purposes, by allowing native lake trout populations to recover, which in turn, aids in the re-establishment of a balanced ecosystem.

*Reduction of Lampricide Use.* The goal of the USFWS's Sea Lamprey Management Program is to apply lampricide to the Bad River to remove sea lamprey larvae without damaging populations of non-target species. Effective lamprey treatment requires knowledge of the chemical and physical characteristics of a stream. Onsite toxicity tests are conducted by the USFWS to determine the specific concentration of lampricide needed to kill sea lamprey without harming non-target species. Pre-treatment studies typically include application of a harmless dye to monitor the downstream flow of water, measurement of stream volume, and analysis of water chemistry to determine variables which may influence treatment effectiveness.

The USFWS treats a river only when the results of preliminary studies indicate that a successful TFM application will result. During application, TFM is metered into the stream for 8-12 hours. The treated water is analyzed periodically at several locations along the stream course and application rates are changed as necessary to ensure proper concentration.

Sea lamprey control strategies of the USFWS are conducted in an attempt to ensure protection of non-target species and the environment. Although TFM is applied at minimal effective concentrations and measured in parts per million, a few species of fish (such as tadpole madtom and lake sturgeon) have tolerance levels only slightly above those of lamprey, and occasionally some of these fish are killed, especially during spawning activities. Consequently, TFM treatments are routinely scheduled to avoid these sensitive species during their spawning seasons.

The USFWS lamprey control crews continually strive to reduce the quantity of TFM used during treatments. For example, during the 1995 treatment the use of TFM was reduced by 31% over the previous treatment of the Bad River. This reduction was a result of crews treating the entire Bad River system at one time and limiting the concentration to 1.3 mg/l, or just above the minimum lethal concentration required to kill sea lamprey larvae. Previous treatments had been conducted in stages with portions of the river system being treated at different times and at concentrations nearer to 1.5 mg/l. As treatment technology improves USFWS lamprey control crew supervisors are confident that further reductions in TFM use can be realized.

*Alternatives to Lampricide.* The Great Lakes Fishery Commission is committed to reductions in TFM use through the implementation of alternative lamprey control strategies. While lampricide has been proven an effective control technique, work toward less dependence on chemical control and improved integrated management of sea lamprey continues in the effort to protect the Great Lakes Fishery.

The Bad River Band would like the use of lampricides and other chemicals to be reduced and eventually eliminated. Tribal leaders and BRNRD have expressed strong interest in alternative controls for sea lamprey, such as the release of sterile males in the Bad River, and placement of a barrier to block upstream migration of spawning-phase sea lampreys. Studies by the USFWS are in progress to determine the effect of

a sea lamprey barrier on the movements of lake sturgeon and walleye in the Bad River.

The sterile male release technique is an experimental alternative control method to lampricide treatments in the Great Lakes. Field and laboratory studies have shown that release of sterilized male sea lampreys reduced the production of lamprey in streams at a predictable rate (Bergstedt et al. 1995).

From 1992-1996, approximately 14,500 sterile male sea lamprey were released into the Bad River. Table E2b shows the estimated population of male sea lamprey, the number of sterile males released, the estimated ratio of sterile to normal males, and the predicted reduction in larval production from 1992-97. Long-term effectiveness of the sterile male release technique in Lake Superior tributaries will be evaluated by the Great Lakes Fishery Commission through measurement of fish and lamprey abundance. Due to tribal support of the release of sterile male lamprey as an experimental alternative control, the USFWS has committed to continue this program in the Bad River.

Table E2b. The estimated population of male sea lamprey in the Bad River, the number of sterile male sea lamprey released, the estimated ratio of sterile to normal males, and the predicted percent reduction in larval production.

Year	Est. male population	Sterile males released	sterile: normal males	Predicted % Reduction
1997	1,875	1,500	0.8:1	45%
1996	4,108	1,669	0.4:1	29%
1995	1,152	2,151	1.9:1	66%
1994	1,129	3,500	3.1:1	76%
1993	1,231	3,927	3.2:1	76%
1992	1,404	3,170	2.3:1	70%
1991	-	0	-	-

*Potential Lamprey Management Options.* Currently the use of TFM is the only proven effective method of sea lamprey control in the Bad River; none of the alternative control options currently available completely eliminates the need for use of TFM for sea lamprey control. The Great Lakes Fishery Commission is committed to development of alternative control techniques for sea lamprey control. Treatment options currently available or under development include barrier construction and release of sterilized female lamprey, which are summarized below. Additional options will certainly arise as the Great Lakes Fishery Commission carries out its commitment to develop alternative control techniques.

*Barrier Construction.* In 1994, USFWS sea lamprey control barrier coordinators completed a review of more than 100 streams in the Great Lakes basin for potential barrier sites. This review found that due to topography there is no suitable site for barrier construction that would eliminate access of sea lamprey to all areas of spawning habitat in the Bad River system. Therefore, construction of a barrier would not preclude the need for other methods of control, including lampricide treatment of the lower Bad River and White River.

Sites identified as being technically feasible for construction of a barrier include the Elm Hoist bridge and the upper and lower falls on the Bad River. Due to cultural and environmental issues (for example, allowing the passage of desirable fish species to their spawning grounds and the aesthetic value of a free-flowing river) the site most likely to be suitable for a barrier is at the Elm Hoist bridge.

In recent treatments about 126 miles of the Bad River system were exposed to lampricide, including the main stem of the Bad River, the lower White River, the Potato River, and the Marengo River. The proposed barrier site (the Elm Hoist bridge) on the Bad River would greatly reduce the length of stream requiring treatment to an estimated 13 miles of the lower Bad River and 23 miles of the lower White River.

Currently, an effective sea lamprey trap on the Bad River does not exist. The assessment trap network at the lower falls captures about 7% of the sea lamprey spawning run. A well-designed trap built into a barrier, such as that on the Brule River, can capture 70% or more of the spawning run. Such an effective barrier has the benefit of reducing the number of spawners below the barrier, and it also would

enhance the effectiveness of the Sterile Male Release Technique, currently implemented on the Bad River, by increasing the ratio of sterile to fertile males.

Another potential benefit of a barrier is improved fish assessment, such as that provided by the Brule River barrier. A viewing window and videotape recorder furnish fishery assessment data of unparalleled quality upon which to base management decisions.

*Release of Sterile Female Lamprey.* Release of sterilized female lamprey has been proposed by the Sterile Male Release Technique Task Force as a potential alternative method to help reduce the lamprey population. The presence of sterile males causes a portion of the female population to waste their eggs in mating with these males, while a sterile female strategy results in a portion of the available eggs in the population remaining unfertilized because males cannot effectively mate with all the females. Efficacy of a sterile female release technique is affected by the number of eggs that a male can fertilize and the rate of polygamy. The effect of polygamous nesting on the theoretical reduction of offspring would need to be determined before a sterile female lamprey release program could begin.

The availability of large numbers of female lamprey for sterilization may provide effective control in the Bad River, with a potential reduction of 85%. Approximately 30,000 female lamprey could be available for sterilization in 1999, but will become more scarce with success of control efforts in the St. Mary's River. The release of approximately 1,500 sterile males in the Bad River in 1997 will theoretically reduce the population by about 50%. The addition of sterile females to a stream with sterile males offers no additional benefit. If female lamprey were released in the Bad River, the sterile males currently released there would be used elsewhere.

**Appendix E3. River Ruffe Surveillance Summary Data, 1992-1997, Kakagon and Bad Rivers and Sloughs.** Data compiled from Slade et al. (1994 and 1995), Kindt et al. (1996), and Czypinski et al. (1997).

Year	Location	Gear	Total Ruffe Number	Total Effort (hours)	CPUE (#/trawl hour)
1994	Kakagon	BT	0	0.91	0
1995	Kakagon	BT	1	0.48	2.1
1996	Kakagon	Angling	4	Unknown	Unknown
1996	Kakagon	BT	0	0.28	0
1997	Kakagon	BT	82	1.55	52.9
1992	Bad	BT	0	0.80	0
1993	Bad	BT	2	2.98	0.7
1994	Bad	BT	4	1.31	3.1
1995	Bad	BT	7	1.63	4.3
1996	Bad	BT	3	0.65	4.6
1997	Bad	BT	443	2.07	214.0
1997	Bad	Angling	1	Unknown	Unknown
1997	Bad	Shocking	0	3.00	0
1997	Bad	Trap	0	3 nights	0

BT = bottom trawl  
CPUE = catch per unit effort



